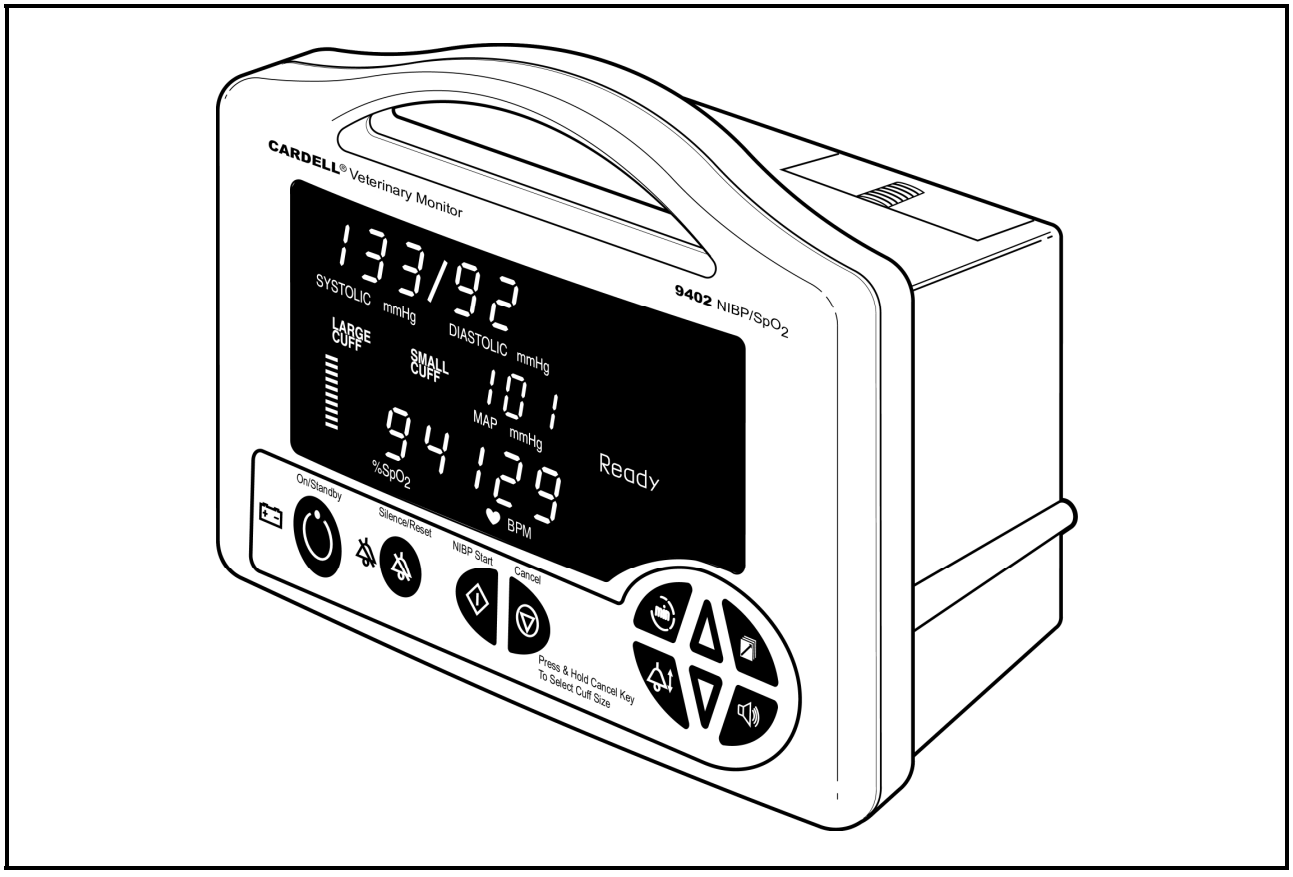
CARDELL®

Veterinary Vital Signs Monitors

Models 9401 and 9402



User's Manual

Manufactured for:

MIDMARK®

CASMED® FOR WHAT'S VITAL

CE

21-02-0285 REV. 06 07/11

CARDELL®
Veterinary Vital Signs Monitors

MODEL	DESCRIPTION
9401	Non-invasive Blood Pressure and Pulse Rate.
9402	Non-invasive Blood Pressure, Pulse Rate and Pulse Oximeter.

IMPORTANT:

This manual addresses all parameters of the CARDELL Veterinary Vital Signs Monitor. Not all monitors have all the parameters referred to in this manual.

Read this Manual completely before using this equipment.

WARNING:

The CARDELL Monitor is to be operated by qualified personnel only. Before use, carefully read this manual, including accessory directions for use, all precautionary information, and specifications. The user must check that the equipment functions safely and see that it is in proper working condition before being used.

In the U.S. the following caution applies:

CAUTION:
Federal law restricts this device to sale by or on the order of a veterinarian.

First Printing: 01/04
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Revised: 09/07
Revised: 05/08
Revised: 05/09

Manufacturers Declaration of Conformity
Electronic Emissions and Immunity

The Model 9401/9402 Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the Model 9401/9402 Monitor should assure it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment
RF emissions – CISPR 11	Group 1	The Model 9401/9402 Monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions – CISPR 11	Class B	The Model 9401/9402 Monitor is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class B	
Voltage fluctuations / flicker emissions	Complies	

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	+/- 6 kV contact +/- 8 kV air	+/- 6 kV contact +/- 8 kV air	Floors should be wood concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	+/- 2 kV for power supply lines +/- 1 kV for input/output lines	+/- 2 kV for power supply lines +/- 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	+/- 1 kV differential mode +/- 2 kV common mode	+/- 1 kV differential mode +/- 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage Dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5% U_T (>95% dip in U_T) for 0.5 cycle. 40% U_T (60% dip in U_T) for 5 cycles. 70% U_T (30% dip in U_T) for 25 cycles. < 5% U_T (> 95% dip in U_T) for 5 seconds.	< 5% U_T (>95% dip in U_T) for 0.5 cycle. 40% U_T (60% dip in U_T) for 5 cycles. 70% U_T (30% dip in U_T) for 25 cycles. < 5% U_T (> 95% dip in U_T) for 5 seconds.	Mains power quality should be that of a typical commercial or hospital environment. If user of the Model 9401/9402 Monitor requires continued operation during power mains interruptions, it is recommended that the Model 9401/9402 Monitor be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE: U_T is the A.C. mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Model 9401/9402 Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the Model 9401/9402 Monitor should insure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the Model 9401/9402 Monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance:**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz Where *P* is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer and *d* is the recommended separation distance in meters. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey [a], should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol:

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is effected by absorption and reflection from structures, objects and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular / cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Model 9401/9402 Monitor is used exceeds the applicable RF compliance level above, the Model 9401/9402 Monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Model 9401/9402 Monitor.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Model 9401/9402 Monitor

The Model 9401/9402 Monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Model 9401/9402 Monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Model 9401/9402 Monitor as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (Watts)	Separation distance according to frequency of transmitter (Meters)		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters operating at a maximum output power not listed above, the recommended separation distance *d* in meters can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer.
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

WARRANTY POLICY

MONITORS

CAS Medical Systems, Inc. warrants the monitor, when new, to be free from defects in material and workmanship and to perform in accordance with manufacturer's specifications for a period of three (3) years from the date of original purchase from CAS or its authorized distributors or agents except as noted below.

The same warranty conditions are made for a period of one (1) year with respect to printer and battery and six (6) months on non-disposable accessories and certain components consisting of reusable SpO_2 sensors and other accessories provided by CAS as part of the original purchase. CAS warrants blood pressure cuffs and disposable or single-patient-use products for out-of-box failure only. Where the accessory is not a CAS manufactured product, the manufacturer's own warranty conditions apply.

CAS reserves the right to perform warranty service operations in its own factory or at an authorized repair station.

Our obligation under this warranty is limited to repairing or, at our option, replacing any defective parts or our equipment, without charge, if such defects occur in normal service and with prompt notification.

Damage to any part through misuse, neglect, or accident, or by affixing any accessories or attachments other than CAS or Nellcor® manufactured accessories or attachments, is not covered by this warranty.

ACCESSORIES, BATTERIES, CUFFS, AND CERTAIN COMPONENTS

In all cases, policy applies from date of purchase from CAS or its authorized distributors or agents.

Batteries:	(1) Year
Chargers:	(1) Year (not including power cord: see other accessories).
Cuffs (all):	Out-of-box failure only.
SpO_2 Cable and Sensor:	(6) Months – Nellcor SpO_2 Cable and Sensor.
Other Accessories:	Out-of-box failure only.
Certain Components:	(1) Year – Printer mechanism, but not including Thermal Print Heads.
Print Heads:	Out-of-box failure only.

THERE ARE NO WARRANTIES, WHICH EXTEND BEYOND THOSE EXPRESSLY DESCRIBED IN THIS AGREEMENT AND THE COMPANY MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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HOW TO CONTACT US

For Warranty Issues:		For Product Usage Information:
CAS Medical Systems, Inc. 44 East Industrial Road Branford, CT 06405 U.S.A. Phone: (800) 227-4414 (203) 488-6056 Fax: (203) 488-9438 E-Mail: techsrv@casmed.com Web: www.casmed.com		**Midmark** 10008 N. Dale Mabry Hwy, Suite 110 Tampa, FL 33618 U.S.A. Phone: Toll Free: 800-Midmark (643-6275) Fax: (813) 264-6218 E-Mail: www.Midmark.com/Pages/Contactus.aspx Web: www.Midmark.com

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1. INTRODUCTION AND INTENDED USE

INTRODUCTION

The CARDELL Veterinary Monitors, Models 9401 and 9402, are vital signs monitors measuring blood pressure and oxygen saturation. The monitors are restricted for use, one patient at a time. Non-invasive blood pressure is measured using the oscillometric technique determining systolic, diastolic, mean arterial pressure and pulse rate. The pulse oximeter function continuously monitors and displays values for functional arterial hemoglobin saturation and a pulse rate.

INDICATIONS FOR USE

The CARDELL Monitor is a portable device intended to be used by trained clinicians for multi-parameter vital signs monitoring of veterinary patients. Parameters displayed are the non-invasive blood pressure (systolic, diastolic and mean arterial pressure), pulse rate and functional oxygen saturation of arterial hemoglobin (%SpO_2).

WARNING:
The CARDELL Monitor is intended only as an adjunct in patient assessment. It must be used in conjunction with clinical signs and symptoms.

CONTRAINDICATIONS

No contraindications are known at this time.

BRIEF DEVICE DESCRIPTION

The CARDELL Monitor is compact, lightweight and portable, allowing it to be easily carried and used in a variety of clinical settings. The monitor is powered by AC Line Power or by a Nickel Metal Hydride (NiMH) rechargeable battery pack. The internal battery pack charges when the monitor is plugged into the AC wall outlet. The CARDELL Monitor can be set to operate in one (1) of ten (10) different languages: English, German, French, Italian, Spanish, Dutch, Swedish, Portuguese, Norwegian or Danish. The message window can display various system alarm messages. These messages direct the user to check conditions such as the battery state, air leaks and measurement problems. The message window also displays the operational mode of the monitor (automatic or manual).

The non-invasive blood pressure (NIBP) parameter automatically inflates an occluding cuff and, using the oscillometric measurement technique, determines systolic, diastolic and mean arterial pressure and pulse rate. Measurement results along with operator prompts and error messages are displayed on the front panel. The frequency of NIBP determination can be selected by the operator in varied times between one and ninety minutes. The auto and manual operating modes cover a variety of clinical uses.

The pulse oximeter parameter (%SpO_2) determines arterial oxyhemoglobin saturation by measuring the absorption of red and infrared light passing through the tissue. Changes in absorption caused by pulsations of blood in the vascular bed are used to determine arterial saturation and pulse rate. The oximeter requires no routine calibration or maintenance. Oxygen saturation and heart rate are displayed on light emitting diode (LED) digital displays.

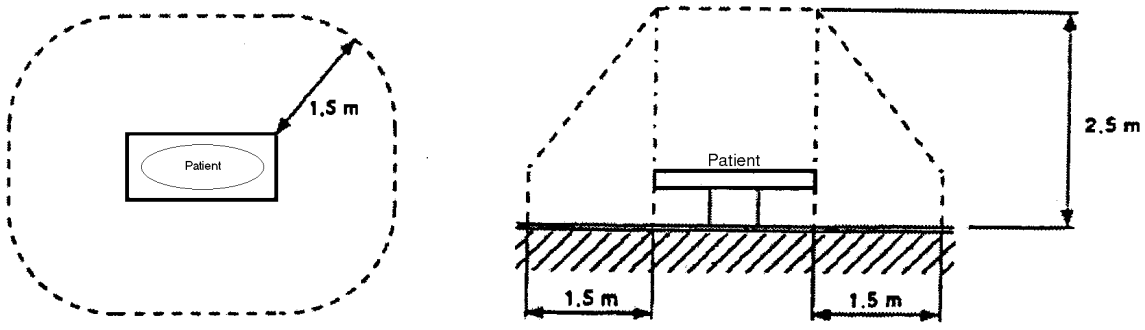
On each detected pulse, the perfusion LED does indicate patient perfusion signals. This bar graph gives the user a pulse-by-pulse visual indication of waveform signal quality. An audio "beep" can be enabled that is generated each time the SpO_2 module detects a pulse.

NOTE:
The bar graph is not proportional to the pulse volume.

PATIENT ENVIRONMENT

The CARDELL Monitor has been tested with specific parts of the "system" used within the Patient Environment. Figure 1, defines the Patient Environment.

Figure 1: **Patient Environment**



The parts of the CARDELL Monitor "system" that can be used in the Patient Environment are defined as;

Table 1: **Parts of the System**

The CARDELL Monitor (9401 / 9402)
Appropriate Accessories, listed in the ACCESSORIES section of this User's Manual
Line Cord
RS232 Communications
Citizen CMP-10 Mobile Printer
RS232 Interconnect Cable (supplied with printer)
AC Adapter / Charger, Model TRC-09-1100-M from Group West or equivalent (supplied with printer)

DEFINITION OF TERMS

In this manual, “WARNING”, “CAUTION”, “IMPORTANT” and “NOTE” mean the following:

WARNING:
Directions that warn of conditions that put the patient or caregiver at risk.

CAUTION:
Directions that help you avoid damaging your monitor or losing data.

IMPORTANT:
Directions you should be particularly aware of; something not readily apparent.

NOTE:
Directions that make it easier to use your monitor.

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2. UNPACKING THE MONITOR

INITIAL INSPECTION

Before unpacking the monitor, inspect the packaging for damage. If there are any signs of damage to the package, a claim should be filed immediately with the shipping agent. It is the receiver's responsibility to notify the carrier's local office to arrange for the pickup of the damaged items. Save the damaged shipping carton as evidence.

Contact CAS Medical Systems Inc. to report external damage and to arrange for repair or replacement of damaged equipment.

The shipping carton should contain the items listed below. Unpack the monitor and account for each item. Inspect each item for signs of external damage, dents, cracks, scratches, etc. If an item is missing or damaged, contact CAS Medical Systems Inc.

Record the monitor model, serial number and date of purchase at the back of this manual.

MONITOR CHECKLIST

Qty	Description
1	Monitor (9401 or 9402)
1	Hospital Grade AC Power Cord
1	Six (6) Foot Inflation Hose
13	Midmark Blood Pressure Cuffs, (7 sizes)
1	Nellcor®, Model # DOC-10 SpO_2 Interface Cable (for Model 9402)
1	Nellcor, VetSat® Veterinary SpO_2 Sensor and Clips (for Model 9402)
1	P9 Calibration Kit (includes T - connector with tubing and male luer plug)
1	Monitor User's Manual

NOTE:
The monitor is shipped with the appropriate line cord for the country and or voltage being used.

OPTIONAL ACCESSORIES

The CARDELL Veterinary Monitor is available with a rolling stand and basket, a soft-sided carrying case, and other optional accessories to fit your needs. Refer to Section 11, ACCESSORIES for part number information.

Contact Midmark for more information.

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3. SYMBOLS

Units may display the following symbols:

Alternating Current

CAUTION: Before using, read instructions included.

The CE Mark signifies the device has met all essential requirements of European Medical Device Directive 89/336EEC.

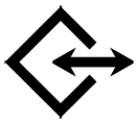
This symbol appears here instead of on the unit.
The first two digits of the unit's serial number indicate the year of manufacture in the 21st century.

Indicates this monitor is subject to the Waste Electrical and Electronic Equipment Directive in the European Union.

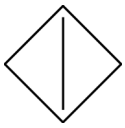
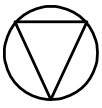
Indicates protection against the effects of the discharge of a cardiac defibrillator. Patient connections are Type BF and protected against defibrillation.

Equipotentiality Ground Post

SYMBOLS (CONT.)

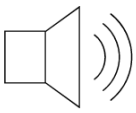
IPX1	Protection against ingress of water.
MAXNIBP®	NIBP Hose and Cuff Connector
SpO_2	Pulse Oximeter Probe Input Connector
	Two-way Communications Port RS232 Interface Connector

These symbols may be used in place of text on the front panel.

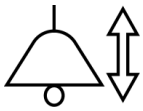
	ON/STANDBY – Turns “ON” the monitor’s display.
	SILENCE/RESET
	START/STAT
	CANCEL
	CYCLE TIME

SYMBOLS (CONT.)

HISTORY



VOLUME



ALARM LIMITS

ARROW UP

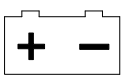
ARROW DOWN

Bar graph display of SpO_2 signal strength.

♥ **BPM** Pulse Rate Display

Large Cuff A lighted LED to indicate NIBP operating with SV8 and SV10 size cuffs or larger.

Small Cuff A lighted LED to indicate NIBP operating with SV1 – SV5 size cuffs.



A tri-colored LED used to indicate the status of the monitors power source.

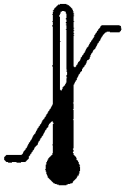
SYMBOLS (CONT.)

These symbols appear on the battery pack in place of text.

Recycling suggested (see General Notes).

These symbols appear on the packaging in place of text.

Symbol used to indicate where Relative Humidity information concerning storage and transport can be located.



Symbol used to indicate the minimum and maximum storage and transport Temperatures.

This symbol appears on the printer in place of text.

WARNING: Before removing, read instructions in Section 8.

4. SAFETY MEASURES AND WARNINGS

WARNING:

The CARDELL MODEL 9401 and 9402 monitors are intended for VETERINARY USE ONLY. Do no use on human patient.

Do not use this instrument for any purpose other than specified in this manual. Doing so will invalidate the monitor's warranty.

Do not connect more than one (1) patient to the monitor.

Do not plug the monitor into an outlet controlled by a wall switch.

Before each use, verify that the alarm limits are appropriate for the patient being monitored.

The position of subject, physiological condition, and other factors affect the readings.

Blood pressure and pulse can fluctuate greatly between measurements; the monitor cannot alert the user to changes in vital signs occurring between measurement cycles.

Occasionally, electrical signals at the heart do not produce a peripheral pulse. If a patient's beat-to-beat pulse amplitude varies significantly (for example, pulsus alternans, atrial fibrillation, rapid-cycling artificial ventilator), blood pressure and pulse rate readings can be erratic and an alternate measuring method should be used for confirmation.

Where the integrity of the external protective conductor in the installation or its arrangement is in doubt, EQUIPMENT shall be operated from its INTERNAL ELECTRICAL POWER SOURCE.

Isolation of product from mains can only be achieved by removal of external power cord.

Do not, under any circumstances, perform any testing or maintenance on the monitor or power cord while the unit is being used to monitor a patient. Unplug the power cord before cleaning or servicing the monitor. The operator should not perform any servicing except as specifically stated in this manual.

Do not touch part of non-medical electrical equipment in the patient environment after removal of covers, connectors etc… without the use of a tool which operate at voltages not exceeding 25 VAC or 60 VDC and the patient at the same time.

Do not use a frayed or damaged power cord, or any accessory if you notice any sign of damage. Contact Midmark for assistance.

Equipment not suitable for use in the presence of a FLAMMABLE ANESTHETICS.

Equipment is not intended to be used in Oxygen Enriched Atmospheres.

WARNING:

The use of accessory equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- Use of the accessory in the Patient Environment.
- Evidence that the safety certification of the accessory has been performed in accordance with the appropriate IEC 60601.1 and/or IEC 60601.1.1 harmonized national standard.

Do not gas sterilize or autoclave the monitor.

Do not use the monitor in the presence of Magnetic Resonance Imaging (MRI) equipment.

Do not apply the blood pressure cuff on an extremity being used for an intravenous infusion.

Do not place liquids on top of the monitor. Do not immerse the monitor or power cord in water or any liquid. If unit is accidentally wetted it should be thoroughly dried. The rear cover can be removed by a qualified service technician to verify absence of water.

Accurate oxygen saturation measurement cannot be obtained with the Model 9402 when the oximeter is not measuring the pulse properly. If the perfusion bar graph or the PULSE RATE be erratic or inaccurate, first examine the animal for any signs of distress and only then re-examine sensor placement.

Inadequate perfusion, thick fur, dark skin or foreign matter that blocks light or an improperly applied sensor can result in erratic and inaccurate oxygen saturation and/or pulse rate measurement. Should the perfusion bar graph be at a low level, reposition the sensor or try a different sensor. If proper operation cannot be verified, remove the sensor from the animal and do not use the oximeter on this animal.

In the event the sensor becomes dislodged from the animal, audible and visual alarms are activated requiring that a veterinary professional investigate the reason for the alarm status. The veterinary professional should investigate status and sensor attachment after every sensor alarm indication. It is possible when the sensor is dislodged from the animal (under certain conditions of light and vibration of the sensor) for the pulse oximeter to display normal physiological values.

WARNING:

ACCURACY – If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by alternate means and then check the CARDELL Monitor for proper functioning.

CABLES – Route all cables away from patient's throat to avoid possible strangulation.

DEFIBRILLATION – Do not come in contact with patients during defibrillation. Serious injury or death could result.

DISPOSAL – Dispose of the packaging material, observing the applicable waste control regulations.

LEAKAGE CURRENT TEST – The interconnection of auxiliary equipment with this device may increase the total leakage current. When interfacing with other equipment, a test for leakage current must be performed by a qualified biomedical engineering personnel before using with patients. Serious injury or death could result if the leakage current exceeds applicable standards.

SITE REQUIREMENTS – For safety reasons, all connectors for patient cables and sensor leads are designed to prevent inadvertent disconnection, should someone pull on them. Do not route cables in a way that they may present a stumbling hazard. For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

CAUTION:

Before each use, make sure that the monitor default alarm settings are appropriate for the specific patient being monitored.

Pressing the front panel keyswitch with a sharp or pointed instrument may permanently damage the keyswitch. Press the keyswitch using only your finger.

As with any non-invasive oscillometric blood pressure monitor, the accuracy of the measurements obtained may be adversely affected by the presence of agents which alter the patient's cardiovascular system.

A calibration check is recommended once every year.

Do not alter the monitor's air hose. CAS Medical Systems cannot ensure proper monitor performance if the tubing is altered. Modification of the air hose will void the warranty. Avoid compression or restriction of pressure tubes.

If the cuff is applied on a limb being used for oxygen saturation monitoring %SpO_2 results will be altered during each blood pressure measurement due to the occlusion of blood flow.

Inspect the monitor, air hose and sensors for any damage prior to operation. If any damage is noted, the monitor should not be used until it has been serviced. The monitor should be repaired only by personnel authorized to do so by CAS Medical Systems, Inc.

Use only CAS Medical Systems approved accessories and sensors to preserve the integrity, accuracy and the electromagnetic compatibility of the monitor.

Consult a physician for interpretation of blood pressure measurements.

The oximeter is factory calibrated to determine the percentage of arterial oxygen saturation of functional hemoglobin.

Significant levels of dysfunctional hemoglobins such as carboxyhemoglobin or methemoglobin may affect the accuracy of the measurement.

Cardiogreen and other intravascular dyes, depending on the concentration, may affect the accuracy of the oximeter measurement.

Some sensors may not be appropriate for a particular patient. If at least ten seconds of one bar pulses cannot be observed for a given sensor, change sensor location until this condition is achieved.

If the monitor fails to respond, do not use it until the situation has been corrected by qualified personnel.

CAUTION:

ACCIDENTAL SPILLS – In the event that fluids are accidentally spilled on the monitor, take the monitor out of operation and inspect for damage.

BATTERY POWER – If the monitor will not be used or not connected to AC line power for a period over six (6) months, remove the battery.

ELECTRICAL SHOCK – To reduce the risk of electrical shock, do not remove the back cover. Refer all servicing to qualified personnel.

ELECTROMAGNETIC COMPATIBILITY (EMC) – The equipment needs special precautions regarding EMC. Be aware that strong electromagnetic fields may interfere with monitor operation. Interference prevents the clear reception of signals by the monitor. If the hospital is close to a strong transmitter such as TV, AM, or FM radio, police or fire stations, a HAM radio operator, an airport, or cellular phone, their signals could be picked up as signals by the monitor.

ELECTROSURGERY – Measurements may be affected in the presence of strong electromagnetic sources such as electro surgery equipment.

GROUNDING – Do not defeat the three-wire grounding feature of the power cord by means of adaptors, plug modifications, or other methods. Do not use extension cords of any type. Do not connect the monitor to an electrical outlet controlled by a wall switch or dimmer.

INTERFACING OTHER EQUIPMENT – Monitoring equipment must be interfaced with other types of medical equipment by qualified biomedical engineering personnel. Be certain to consult manufacturers' specifications to maintain safe operation.

STACKING – Where monitor is used adjacent to or stacked with other equipment, the monitor should be observed to verify normal operation in the configuration in which it will be used.

GENERAL NOTES:

There are no known risks with common disposal of equipment or accessories; however, the disposing of accessories should follow in accordance with local hospital policies. The user should ensure these policies do not conflict with any local, state or federal guidelines.

The monitor is suitable for use in the presence of electro surgery.

The monitor is suitable to be connected to public AC mains power.

The CARDELL Monitor is not “Category AP or APG Equipment”.

The CARDELL Monitor is for “Continuous Operation”.

The CARDELL Monitor applied parts are “Type BF Defibrillation Proof”.

The CARDELL Monitor provides “DRIP-PROOF” level of protection from ingress to moisture. Do not expose the CARDELL Monitor to extreme moisture levels such as direct exposure to rain. Exposure to extreme moisture levels may cause incorrect or inaccurate performance or device failure during or after exposure.

AUTOMATIC SAFETY FEATURES

The monitor has been designed for patient safety. The maximum amount of time allowed to complete a blood pressure measurement is 150 seconds. If the measurement has not been completed within that time, the cuff is deflated automatically and a message is displayed indicating the problem.

To prevent exposure of the extremity to an inordinately high pressure, the cuff is deflated automatically when the pressure in the system is greater than 290 mmHg.

In the event of a microprocessor failure, the cuff will be deflated automatically within ten (10) seconds.

All equipment parts are protected against the effects of the discharge of a defibrillator. No separate actions are required when using this equipment with a defibrillator.

Should the AC or DC power be interrupted coming into the monitor, the monitor automatically runs off battery power. An indication of this would be a change in color of the Battery Charge LED from Green to either Orange or Red.

Whenever the power is disconnected from the monitor and the monitor is not allowed to shut down in an orderly fashion, the monitor, when re-powered alerts the user. Refer to Page 74, POWER FAIL for more information.

CAUTION:

Regardless of these safety features, always be sure to check that there are no signs of prolonged impairment of patient circulation and that the monitor is functioning properly.

5. BLOOD PRESSURE MONITORING

CUFF SELECTION AND APPLICATION

The use of properly designed and sized cuffs is essential for the accurate non-invasive measurement of blood pressure. Midmark cuffs are recommended for use with the CARDELL Monitor.

NOTE:
CAS recommends the use of Midmark cuffs with the CARDELL Monitor.

CAS recommends the use of the inflation hose supplied with the monitor or a replacement from CAS.

The widest cuff that can be placed around the limb should be used. A cuff that is too small for the limb will not supply sufficient occlusion pressure to the artery. This can cause an erroneously high blood pressure reading. Ideally, cuff width should be 40% of the limb circumference. Substitution of a cuff different from that supplied might result in a measurement error.

NOTE:
Overlapping the cuff will not affect the measurement results.

For best results, a cuff should be wrapped for a snug fit and be positioned reasonably close to heart level. Measurements made above the level of the heart will give reduced blood pressure readings. Measurements made below the heart level will give increased readings. These errors are mainly due to the weight of the blood.

NOTE:
Avoid compression or restriction of the NIBP Inflation Hose. The hose must not be kinked or pinched. It can be placed in any position, but it should be kept off the table surface to avoid equipment vibrations.

WARNING:
The cuff should not be applied on a limb being used for an intravenous infusion. Do not place the cuff on any extremity being used for SpO_2 monitoring.

See Section 11, ACCESSORIES for CAS Medical Systems cuff size and part number information.

SITE SELECTION

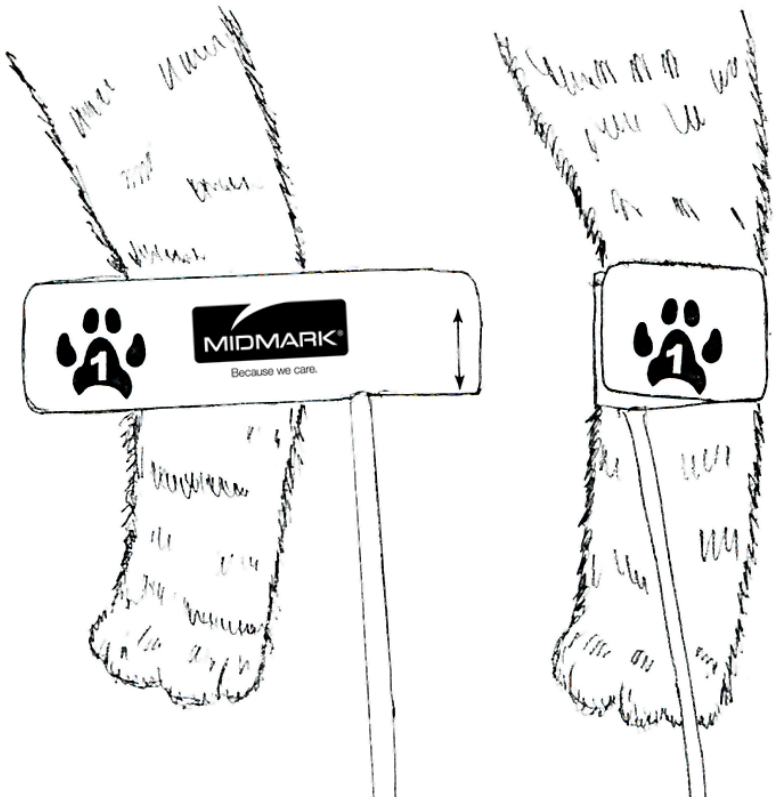
Place the patient on a padded surface or chair to provide comfort. Shivering will inhibit the monitor from making a determination.

CUFF PLACEMENT FOR A CAT

A cat may be left in its owner's lap to keep it calm. Measurements are best done in an area of the hospital away from noise and bright lights. The animal may be held so that the front limbs are free for cuff placement. In conscious patients, the tail may be the most appropriate location for placement of the cuff. Cats may be most comfortable in sternal recumbency making the tail a more preferable site.

For the median artery on the foreleg, place the cuff around the forelimb, between the elbow and carpus. Hair need not be clipped except when heavily matted. In cats less than five (5) pounds when measurements are difficult to obtain, place the cuff around the leg above the elbow to obtain measurements from the brachial artery. Measurements from the coccygeal artery may be used by placing the cuff around the base of the tail but not in anesthetized patients.

Figure 2: **Cat Cuff Placement**



CUFF PLACEMENT FOR A DOG

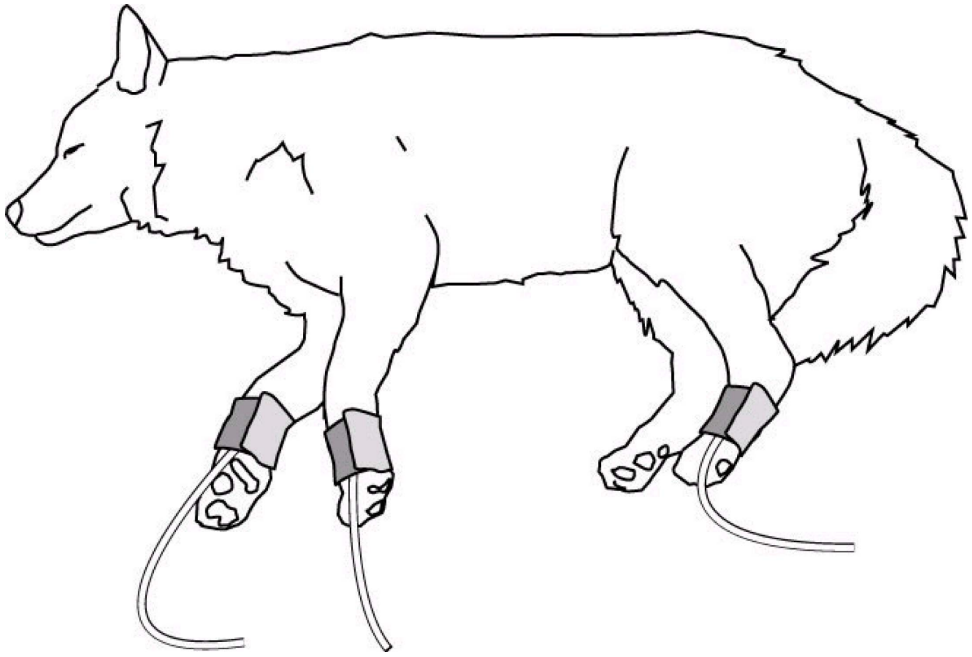
For measurements in dogs, it is preferable to use the right lateral, sternal or dorsal recumbent positions. That is not a problem in anesthetized patients, but it may be difficult to get large dogs to cooperate for proper positioning. If the dog is in a sitting position, place the front paw on the operator's knee and take measurements from the metacarpus.

Sites for cuff placement are the metacarpus, metatarsus and anterior tibial. In anesthetized patients, most surgeries are done on the posterior part of the body so the metacarpal area of the forelimb is most convenient. In situations where this is not possible, the cuff should be wrapped around the metatarsus just proximal to the tarsal pad or around the hind leg just distal to the hock. The tail site should not be used for cuff placement during anesthesia.

If the hair over the artery site is too thick or matted for good contact, it should be clipped.

Figure 3: **Dog Cuff Placement**

NOTE:
Use metacarpus or metatarsus.



To achieve the most accurate readings, it is important to keep the cuff on a horizontal plane with the heart.

LARGER ANIMALS

A large animal such as a horse should be in a stock, standing still, or lying down.

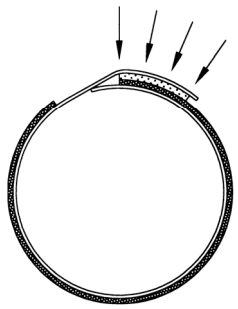
For horses and cows, the cuff can be wrapped around the base of the tail using the coccygeal artery on the ventral surface.

WARNING:
When monitoring over an extended period of time, or at frequent intervals, periodically observe the patient's limb to make sure that the circulation is not impaired for a prolonged period of time.

CUFF SIZE SELECTION

The widest cuff that can be placed on the patient, without extending beyond the joint, should be selected. Appropriate sized cuffs may be selected based on published guidelines that cuff width should be 40 – 60% of limb circumference. The cuff should be wrapped for a snug fit. Overlapping the cuff will not affect measurement results. Make sure the hook and loop sections of the cuff are fully engaged when it is wrapped around the limb. If not fully engaged, the cuff will detach during bladder inflation. If that happens, select the next size bigger cuff. Adhesive tape or other material should not be used to secure the cuff.

Figure 4: **Full Velcro® Engagement**



Use the following table as a guide to select the correct size.

Table 2: **Small Animal Cuff Selection**

Cuff Model Number	Bladder Size (Width)	Limb Circumference Range
SV1	2.0 cm (0.8 in.)	3 – 6 cm (1.2 – 2.4 in.)
SV2	2.5 cm (1.12 in.)	4 – 8 cm (1.6 – 3.1 in.)
SV3	3.5 cm (1.5 in.)	6 – 11 cm (2.4 – 4.3 in.)
SV4	4.0 cm (1.75 in.)	7 – 13 cm (2.8 – 5.1 in.)
SV5	5.0 cm (2.0 in.)	8 – 15 cm (3.1 – 5.9 in.)

Table 3: **Large Animal Cuff Selection**

Cuff Model Number	Bladder Size (Width)	Limb Circumference Range
SV8	9 cm (3.12 in.)	13 – 20 cm (5.1 – 7.9 in.)
SV10	12 cm (4.0 in.)	18 – 26 cm (7.1 – 10.2 in.)

BLOOD PRESSURE REFERENCE VALUES

Which Blood Pressure is Normal in Dogs or Cats?[1]

It is essential to know the reference range of blood pressure in a given species in order to properly evaluate the animal's blood pressure and detect hypertension or hypotension. When using different measurement techniques (oscillometry or direct blood pressure measurements), one must also remember that methodological factors influence results. Therefore, technique-specific reference values should be known. Species-specific, breed-specific, and individual differences in normal blood pressure ranges can be observed. The most accurate assessments are made by comparing different blood pressure readings over time using serial measurements made at regular intervals (at least once yearly). This makes it possible to detect the initial signs of related disease (e.g. cardiovascular and renal disease) more sensitively and at an earlier stage. The normal values for dogs and cats are not identical.

FELINE NORMAL VALUES

The blood pressure values for cats are not breed-specific. However, the most sensitive way to detect changes in feline blood pressure is also by comparing individual blood pressure readings taken over time.

1 Adapted from "Essential Facts of Blood Pressure in Dogs and Cats," Egner, Carr & Brown, © 2003

Normal feline blood pressure: **124/84**

Other investigators have reported comparable reference values:

Feline Reference Values		
Systolic (mmHg)	Diastolic (mmHg)	
125 ± 11	89 ± 9	Brown et al, 1997
123 ± 14	88 ± 15	Curtet, 2001
125 ± 12	86 ± 15	Weber et al, 2002

CANINE NORMAL VALUES

The normal values for dogs are breed-specific. Those for Golden Retrievers, Labradors and giant breeds tend to be lower than the overall average, and those for greyhounds and in general racing hounds tend to be higher. The table that follows, lists the normal values for common dog breeds using oscillometric blood pressure monitors.

Average canine blood pressure: 133/75

This figure was calculated as the mean of 1782 oscillometric measurement in clinically healthy dogs of different breeds. The overall average is therefore serves as a point of reference only. The individual, or at least breed-specific value must be known to most accurately determine whether a given patient's blood pressure deviates from normal.

Breed	Systolic (mmHg)	Diastolic (mmHg)	Pulse Rate
Labrador Retriever	118 ± 17	66 ± 13	99 ± 19
Golden Retriever	122 ± 14	70 ± 11	95 ± 15
Great Pyrenees	120 ± 16	66 ± 6	95 ± 15
Yorkshire Terrier	121 ± 12	69 ± 13	120 ± 14
West Highland	126 ± 6	83 ± 7	112 ± 13
Border Collie	131 ± 14	75 ± 12	101 ± 21
King Charles Spaniel	131 ± 16	72 ± 14	124 ± 24
German Shepherd	132 ± 13	75 ± 10	108 ± 23
Terrier	136 ± 16	76 ± 12	104 ± 16
Bullterrier	134 ± 12	77 ± 17	122 ± 6
Chihuahua	134 ± 9	84 ± 12	109 ± 12
Miniature Breeds	136 ± 13	74 ± 17	117 ± 13
Pomeranian	136 ± 12	76 ± 13	131 ± 14
Beagle	140 ± 15	79 ± 13	104 ± 16
Dachshound	142 ± 10	85 ± 15	98 ± 17
Saluki	143 ± 16	88 ± 10	98 ± 22
Greyhound	149 ± 20	87 ± 16	114 ± 28
Pointer	145 ± 17	83 ± 15	102 ± 14

GUIDELINES[2]

Mean Arterial Pressure (MAP): Minimum to adequately perfuse all peripheral tissue beds: 60 - 70 mmHg.

Hypertension: Suspect with systolic pressure greater than 150 mmHg; affirmed when above 160 - 170 mmHg; also affirmed in cats when diastolic pressure is above 100 mmHg.

Hypotension: During anesthesia, generally maintain systolic pressure above 80 mmHg.

For more information, call Midmark.

2 Info per Dr. Donald Sawyer, Michigan State University

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6. PULSE OXIMETRY MONITORING (Model 9402 only)

The CARDELL Model 9402 Monitor is intended for animal monitoring by trained personnel. It displays numerical values for oxygen saturation and pulse rate. The Model 9402 has provisions for alarm settings.

WARNING:
Use only Nellcor® VetSat® veterinary oxygen transducer (sensor and clips). Use of other oxygen transducers may cause improper oximeter performance. Monitors equipped with Nellcor oximetry will have the Nellcor OxiMax® logo next to the SpO_2 connector. For more information, refer to the Directions for Use pamphlet included with each Nellcor VetSat sensor.

INSTRUCTIONS FOR USE

NOTE:
Reusable sensors may be used on the same site for a maximum of four (4) hours, provided the site is inspected routinely to ensure skin integrity and correct positioning. Because individual skin condition affects the ability of the skin to tolerate sensor placement, it may be necessary to change the sensor site more frequently with some patients.

1) Select a sensor and clip that is appropriate for the patient. There are two (2) sizes of VetSat veterinary sensor clips: model VSC-S (small), and model VSC-L (large).
2) Clean the VetSat sensor and sensor clip separately before and after each use. Refer to Page 87, CLEANING for more information.
3) Open the clip by pressing with the thumb and forefinger.
4) Slide one of the sensor's alignment buttons along the clip slot until the sensor pad is fully engaged in the clip.
5) Slide the second sensor button along the other clip slot until the second sensor pad is fully engaged in its side of the clip.

NOTE:
Check that the VetSat optical sensor pads are facing each other directly.

6) The sensor is now ready to be applied to the patient. The preferred sensor application site for canine, feline and equine animals is on the tongue, with the sensor's optical components positioned on the center of the tongue. Alternatively, the sensor and clip may be applied to the animal's lip, toe, ear, prepuce, or vulva.

NOTE:
If the sensor does not track the pulse reliably, it may be incorrectly positioned-or the sensor site may be too thick, thin, or deeply pigmented to permit appropriate light transmission. If any of these situations occurs, reposition the sensor or try another sensor site. If the sensor site is one that is covered with fur, try shaving the site and reapplying the sensor.

7) Be sure that the sensor cable is positioned along the side of the animal's face and body to avoid entanglement with the animal.

WARNING:
Do not use supplemental tape to adhere the clip and sensor directly to the site; this can restrict blood flow and cause inaccurate measurements. For best results, secure the sensor cable independently from the sensor.

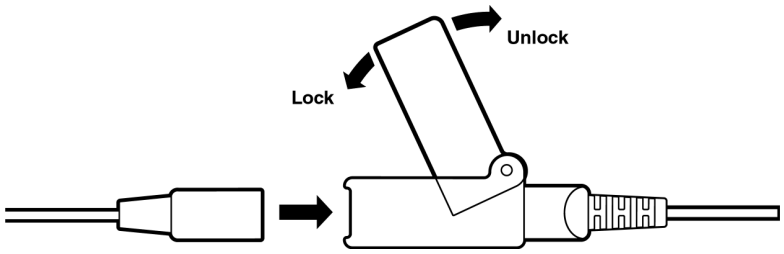
8) Connect the sensor assembly to the Interface Cable:

a) Place the plastic hinged cover in the unlocked position (perpendicular to the connector).

b) Connect the sensor assembly to the Interface Cable.

c) Lock the plastic hinged cover to prevent accidental cable disconnection.

Figure 5: **Sensor to Interface Cable**



9) Plug the Interface Cable into the SpO_2 connector on the side panel of the monitor. The connector is shaped like a "D". Line up the "D" on the Interface Cable with the "D" on the receptacle. Push the cable in until you hear an audible "click".

10) Press the ON/STANDBY pushbutton to turn "ON" the monitor.

11) Verify that the sensor is properly positioned by observing at least ten seconds of continuous green blinking of the signal strength bar (perfusion LED). Should the perfusion light be at a low level, reposition the sensor or try a different sensor. If normal operation cannot be achieved, call a Midmark representative for assistance.

12) Check the Alarm Limits and configure them appropriately for the patient. Refer to Page 60, PATIENT ALARM MODE for more information.

13) If an audio "beep" is required based on the %SpO_2, refer to Page 64, ADJUSTING THE SpO_2 "BEEP" VOLUME for more information.

SENSOR REMOVAL

CAUTION:
For the comfort of the patient and to avoid damaging the sensor, do not pull on the cable when removing the sensor and clip from the sensor site.

When SpO_2 monitoring is completed, remove the sensor from the patient.

To remove the sensor and clip from the patient, press the clip open and remove.

When the probe is removed from the patient, the message “Prb OFF” appears in the Message Window and an audible alarm sounds, indicating a connection has been lost.

Press the SILENCE/RESET pushbutton. The monitor silences the audible alarm tone, but the message remains.

To remove the sensor from the clip, grasp the end of each sensor pad and pull it through to the inside of the clip. The sensor should pop out of the clip easily. Do not pull on the cable.

NOTE:
If either the 2-Minute Audio Off or Permanent Audio Off is enabled, no audio will be heard but a visual message will appear in the Message Window.

REMOVING THE INTERFACE CABLE

When SpO_2 monitoring is not required, disconnect the Interface Cable by squeezing the grey tabs with your thumb and index finger while pulling the connector away from the monitor.

NOTE:
To avoid damage to the Interface Cable, always hold it by the connector rather than the cable when connecting or disconnecting either end. To obtain longer life, avoid excessive kinking or coiling the sensor cable.

When the probe is disconnected from the monitor, the message “No Probe” appears in the Message Window and an audible alarm sounds indicating a connection has been broken.

Press the SILENCE/RESET pushbutton to silence the visual and audible alarm.

NOTE:
If either the 2-Minute Audio Off or Permanent Audio Off is enabled, no audio will be heard but a visual message will appear in the Message Window.

See Section 11, ACCESSORIES for Nellcor oximeter probe types and part number information.

PERFORMANCE CONSIDERATIONS

If there is excessive ambient light, cover the sensor site with opaque material. Failure to do so may result in inaccurate measurements. Light sources that can affect performance include surgical lights (especially those with a xeon light source), bilirubin lamps, fluorescent lights, infrared heating lamps and direct sunlight.

7. MONITOR OPERATION

FRONT PANEL

Figure 6: **Front Panel View**

DIGITAL DISPLAY AND INDICATORS

SYSTOLIC mmHg — Red colored LEDs indicate the Systolic pressure measurement in mmHg.

DIASTOLIC mmHg — Red colored LEDs indicate the Diastolic pressure measurement in mmHg.

MAP mmHg — Red colored LEDs indicate the Mean Arterial Pressure in mmHg.

%SpO_2 (Model 9402) — Green colored LEDs indicate the %SpO_2 value.

♥ **BPM**

Red colored LEDs indicate the Pulse Rate in BPM (beats per minute).

Green colored LEDs provide a visual indication of the SpO_2 signal strength in a bar graph form (Model 9402).

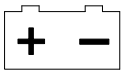
LARGE CUFF

A yellow LED indicating NIBP operating with SV8 and SV10 size cuffs or larger.

SMALL CUFF

A yellow LED indicating NIBP operating with SV1 – SV5 size cuffs.

Message Window area used to display various messages that aid the user in monitor operation.



A tri-colored visual indicator used to indicate the status of the power source and battery condition.

- GREEN = Monitor connected to an AC wall outlet
- ORANGE = In Use on Battery
- RED = Battery Low or Dead Battery

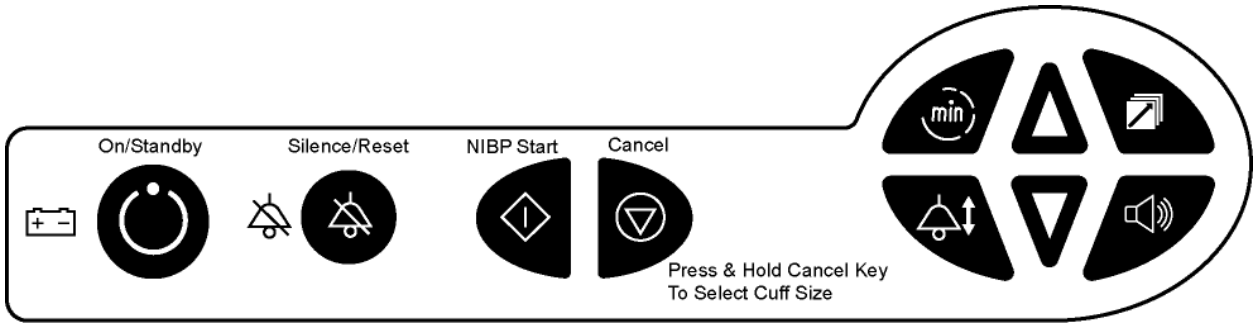
A Yellow LED visual indicator used along with the SILENCE/RESET pushbutton to display the status of the Audio Alarm Silence feature. Refer to Page 68, AUDIO ALARMS (SILENCE/RESET Pushbutton) for more information.

The status of the LED is:

- “ON” continuously = 2 Minute Audio Disable
- Flash one second “ON”/one second “OFF” = Permanent Audio Disable

FRONT PANEL CONTROLS

Figure 7: **Front Panel Controls**



ON/STANDBY:

Press once, turns “ON” the CARDELL Monitor’s display (if it was OFF). Press again, turns the monitor’s display “OFF”.

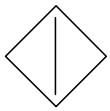
SILENCE/RESET:

When pressed during an active patient alarm, silences the audio portion of that alarm for fifteen (15) seconds.

When pressed during an active equipment alarm, the alarm condition shall be acknowledged along with the audio and visual shall be removed.

Used to enable and disable the two (2) Minute Audio Off or Permanent Audio Off feature. Refer to Page 63, CLEARING ALARMS for more information.

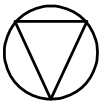
Allows the user to clear NIBP and SpO_2 messages from the front panel display.



START/STAT:

START:
Initiates a blood pressure measurement in the Manual Mode or begins the selected automatic cycle.

STAT:
Starts a series of NIBP measurements (press and hold for two (2) seconds). Continues for five minutes.



CANCEL:

Cancels any active blood pressure function and immediately deflates the cuff.

Press and hold for two (2) seconds to change between Large Cuff and Small Cuff NIBP Modes.

Also used to Cancel out of a menu and return to “Ready”.

CYCLE TIME:

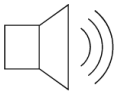
Allows the user to select a time interval for Automatic blood pressure measurement.

Automatic measurement cycles of 1, 2, 3, 4, 5, 10, 15, 30, 60, or 90 minutes may be chosen.

Also used to read the monitor’s current time (press and hold for two (2) seconds).

HISTORY:

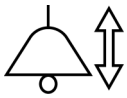
Allows the user to review stored patient readings. Refer to Page 57, HISTORY MODES for more information.



VOLUME:

Used to set the volume level of the Alarms and the SpO_2 Beep (Model 9402). Use the Up and Down Arrows to change.

Also used to adjust the brightness of the front panel displays (press and hold for two (2) seconds).



ALARM LIMITS:

Allows the user to enter and set the monitor's Alarm Limits.

ARROW UP:

Allows forward Adjustment (Auto Cycle, History, Inflation Pressure, Limits and Monitor Configuration).

Press to cycle through menu selections or press and hold for quicker advance.

ARROW DOWN:

Allows backwards Adjustment (Auto Cycle, History, Inflation Pressure, Limits and Monitor Configuration)

Press to cycle through menu selections or press and hold for quicker advance.

NEXT

The **HISTORY** and **VOLUME** pushbutton keys (right side of the Up and Down Arrow keys) have been programmed to allow the user to advance forward to the ***next*** selection in the Monitor Configuration menu.

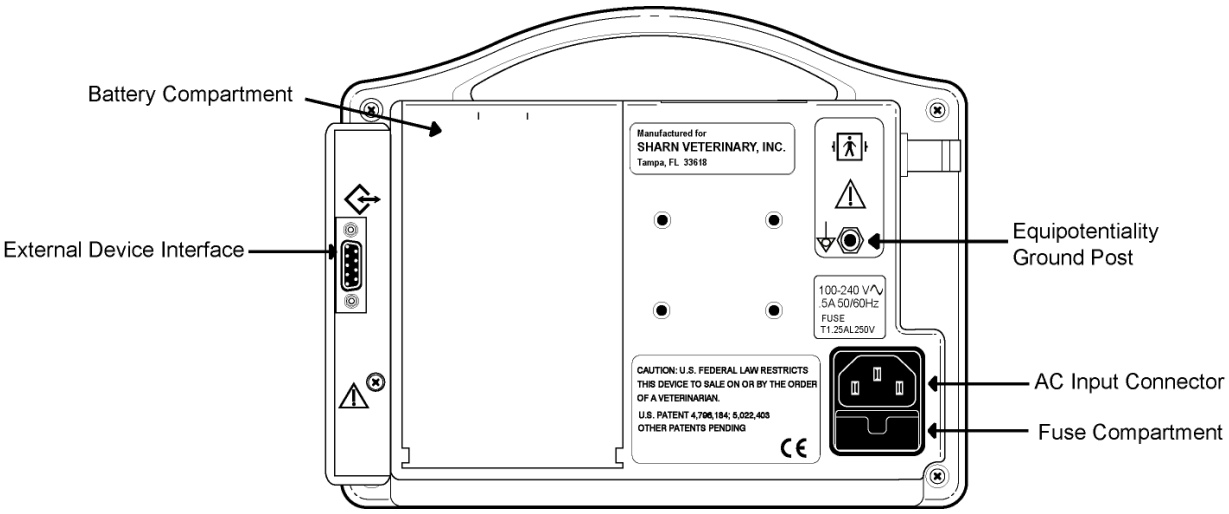
PREVIOUS

The **CYCLE TIME** and **ALARM LIMITS** pushbutton keys (left side of the Up and Down Arrow keys) have been programmed to allow the user to advance backwards to the ***previous*** selection in the Monitor Configuration menu.

REAR PANEL

Figure 8: **Rear Panel View**

Monitor shown with optional RS232 Communications Module



AC LINE POWER CONNECTOR

Receptacle for the AC power cord.

FUSE COMPARTMENT

The power input receptacle incorporates dual fuses located in the hot and neutral lines.

BATTERY COMPARTMENT

The CARDELL Monitor is equipped with a 7.2 Volt, 3700 mAhr battery pack that, when fully charged, is capable of taking 100 NIBP readings when the monitor is set in the 5-minute Automatic Mode.

NOTE:
The serial number label is located on the bottom of the monitor.

EQUIPOTENTIALITY GROUND POST

This terminal can be used to provide an auxiliary ground for the monitor.

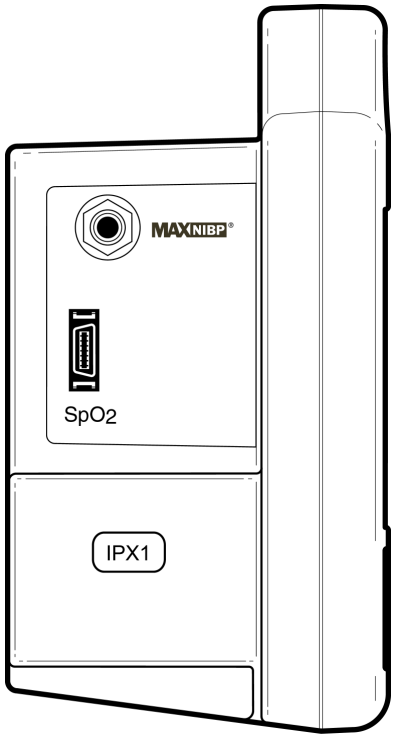
EXTERNAL DEVICE INTERFACE

The CARDELL Monitor is available with an optional DB9 RS232 serial output connector that is used to interface to the Citizen CMP-10 Mobile Printer or another serial printing device.

Refer to Section 8, EXTERNAL PRINTER (optional) for more information.

LEFT SIDE VIEW

Figure 9: **Left Side Panel View**



MAXNIBP®

CUFF HOSE CONNECTION

The six (6) foot, Inflation Hose is connected to the monitor where the MAXNIBP logo is located as shown in Figure 9. The hose must be connected to the cuff prior to use.

NELLCOR® VET SpO_2 SENSOR CONNECTION

(Model 9402 only)

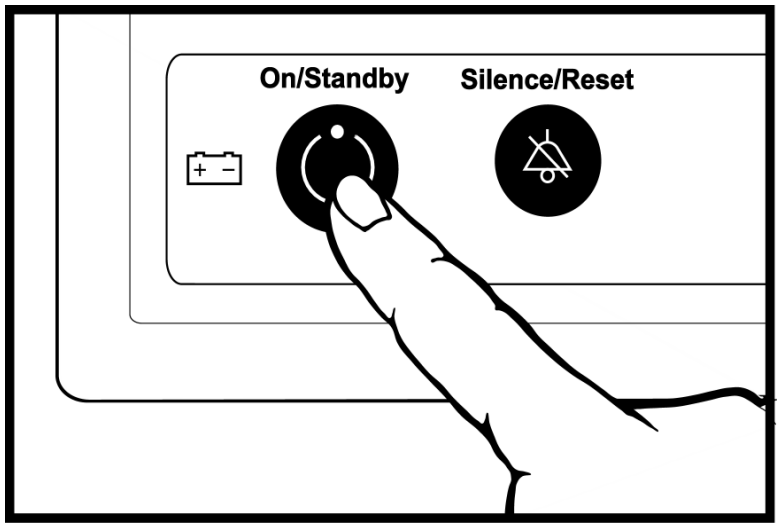
The SpO_2 connector is compatible only with Nellcor® VetSat® veterinary sensor. Connect the Interface Sensor cable in this receptacle for SpO_2 monitoring.

MONITOR OPERATING INSTRUCTIONS

TURNING THE CARDELL MONITOR "ON"

Press the ON/STANDBY pushbutton on the front panel to turn the monitor "ON".

Figure 10: **Turning the Monitor On**



Each time the monitor is turned "ON", a brief electronic song will play while the Power On Self-Test (POST) is conducted to ensure that its internal circuits are functioning properly.

NOTE:
The user should use the Power On Self Test as a verification tool that all front panel visual indicators and the audio are functioning properly.

The one (1) second Configuration Setup Test is a visual indication of the CARDELL Monitor's Model number (9401 or 9402).

The four (4) second Power On Self-Test consists of:

- The monitor plays its start-up song from the internal speaker.
- All equipped parameter segments are lit for one (1) second.
- All High Alarm Values are displayed for one (1) second in their corresponding numeric display window and an audible tone is emitted from the monitor's internal speaker. The Message Window indicates "HI LIMS".
- All Low Alarm Values are displayed for one (1) second in their corresponding numeric display window and an audible tone is emitted from the monitor's internal speaker. The Message Window indicates "LO LIMS".
- The current time is displayed for 1 second.

NOTE:
If the printer was powered "ON" during the monitor's power-up sequence, the Midmark logo is printed.

Once the Power On Self-Test is completed, the monitor indicates that it is "Ready" for use.

FRONT PANEL INTENSITY CONTROL

The CARDELL Monitor utilizes Super Bright LED displays in its front panel for better viewing in a variety of environments. If the displays are too bright or should the need come to operate the monitor in a dimly lit environment, the monitor incorporates a user selectable Intensity Control.

Press and hold the front panel AUDIO pushbutton for two (2) seconds. The monitor's front panel LED displays will toggle from their bright to their dim intensity level.

Continue to press the AUDIO pushbutton and every two (2) seconds the monitor's front panel LED displays will toggle; dim to bright, bright to dim. Release the AUDIO pushbutton and select the intensity level required. The CARDELL Monitor remembers this setting and will power-up the next time to the intensity level selected.

DISPLAYING THE TIME

The CARDELL Monitor can be used to display the current Time of day (as set by the user) at any time. Press and Hold the CYCLE TIME pushbutton for two (2) seconds.

The monitor displays the Time, in 24 Hr. format in the Message Window for as long as the pushbutton is pressed.

LARGE CUFF / SMALL CUFF OPERATING MODES

NIBP function is affected by changing between LARGE CUFF and SMALL CUFF operating modes. Once the monitor's power is on, a visual indicator, located on the front panel of the monitor, indicates the current operating mode.

Press and Hold the CANCEL pushbutton for two (2) seconds to change the operating mode.

IMPORTANT:
Prior to patient monitoring, ensure the monitor is configured to the appropriate patient mode – Large Cuff or Small Cuff. The factory default is SMALL CUFF mode.

MANUAL MODE FOR BLOOD PRESSURE DETERMINATION

Select the appropriate sized cuff for the patient being monitored. Refer to Section 5, BLOOD PRESSURE MONITORING for more information.

Connect the cuff to the end of the monitor tubing. Connect the monitor tubing to the NIBP connector, located on the left side of the monitor.

The default Initial Inflation Pressure is 150 mmHg. To select an alternate Initial Inflation Pressure, press either the ARROW UP or the ARROW DOWN pushbutton.

IMPORTANT:

Excessive patient motion can contribute to inaccurate measurements. It is important that the animal be kept still during a measurement. Make every attempt to alleviate fear, anxiety and pain. Stroking the animal before and during the measurement or having the animal held by the owner may be helpful.

Since fear and anxiety may affect the blood pressure, it is advisable to take at least three measurements to allow the animal to relax. Taking five measurements will allow you to discard the upper and lower values and average the middle three.

Press the START pushbutton to begin a measurement. For the first measurement the monitor will inflate to the default setting or the Initial Inflation Pressure selected.

NOTE:

When the monitor is configured in the Alarms Off mode, the message “Alrm Off” is displayed in the Message Window, the cuff inflation pressure will always be set to 150 mmHg. Also, as an example, if the Initial Inflation Pressure was set to 100 mmHg, the first NIBP inflation pressure would be 100 mmHg followed by pressures at 150 mmHg.

The monitor’s front panel NIBP displays will indicate all dashes “- -“ while the measurement is in progress and the Message Window displays the Inflation Pressure in the format “Meas XXX”, where “XXX” is the pressure value. For subsequent measurements, the monitor will inflate approximately 30 mmHg higher than the previously determined Systolic pressure.

The measurement typically takes less than 30 seconds to complete. In no case will the cuff remain pressurized for more than 150 seconds.

When the measurement is completed, the cuff will automatically deflate and the monitor will display the Systolic, Diastolic, MAP (if enabled), and Pulse Rate values on the front panel displays. The Message Window displays a time stamp of the NIBP measurement in the format “BP HH:MM”. Where “HH” is the hour and “MM” is the minute of the measurement taken.

NOTE:

If SpO_2 is active, the Pulse Rate value will be determined from the SpO_2 measurement.

Press the CANCEL pushbutton, at any time, to stop a measurement and deflate the cuff during the measurement process. The monitor's front panel NIBP displays will indicate all dashes "- -" and the Message Window returns to "Ready".

The CANCEL pushbutton can be pressed after a measurement is taken to clear the current reading from the displays. The monitor's front panel NIBP displays will indicate all dashes "- -" and the Message Window returns to "Ready".

NOTE:
If any displayed NIBP measurement were to be left on the display for up to twenty-four (24) hours, the monitor will automatically blank the displays to all dashes "- -" and the Message Window returns to "Ready".

AUTOMATIC CYCLE FOR BLOOD PRESSURE DETERMINATION

The CARDELL Monitor can automatically take blood pressure measurements at pre-selected time intervals.

To choose a time interval, press the CYCLE TIME pushbutton. The Message Window displays the format "Auto XX". Where "XX" is the time interval in minutes.

Choose the time interval using one of the following methods:

Press the CYCLE TIME pushbutton to advance through the available time intervals.

Press the ARROW UP or ARROW DOWN pushbutton keys to advance forward or backwards through the available time intervals.

Once a time interval has been selected, press the START pushbutton to begin the first measurement.

Between each measurement, the Message Window will display the time remaining until the next measurement, as well as the cycle time chosen in the format "MM:SS CC" where "MM" is the minutes, "SS" is the seconds and "CC" is the cycle time selected.

The measurement results are displayed on the front panel until the start of the next measurement cycle.

NOTE:
If a measurement is desired between measurement cycles, press the START pushbutton. After this measurement, the monitor will re-enter the Automatic Cycle mode and countdown to the next measurement based on the Cycle time selected.

In the Automatic Mode, while during a measurement or in the idle time between measurements, pressing the CANCEL pushbutton will cause the monitor to exit the Automatic mode and return to the Manual mode. The monitor's front panel NIBP numeric displays will indicate the reading of the *previous* measurement taken and the Message Window will display the time stamp of that reading.

STAT MODE

WARNING:
Readings obtained during STAT mode may not meet the stated accuracy of this monitor.

WARNING:
In some cases, rapid, prolonged cycling of an oscillometric, noninvasive blood pressure monitor cuff has been associated with ischemia. Apply the oscillometric cuff appropriately, according to instructions, and check the cuff site and cuffed extremity regularly when blood pressure is measured at frequent intervals or over extended periods of time.

The CARDELL Monitor can automatically take a series of blood pressure measurements for a five (5) minute interval with a brief (approx. ten (10) second) pause between determinations to allow venous blood return.

Press and hold the START/STAT pushbutton for two (2) seconds to activate this feature. The Message Window will display "STAT XXX", where “XXX” is the real time cuff pressure. Between readings the Message Window will display "0:XX S" where “XX” is the 10-second count down until the next measurement.

After five (5) minutes of determinations the monitor will stop taking measurements and exit the STAT mode. The monitor will return to the Manual mode and the Message Window will return to the "Ready" message.

In the STAT Mode, while during a measurement or in the idle time between measurements, pressing the CANCEL pushbutton will cause the monitor to exit the STAT mode and return to the Manual mode. The monitor’s front panel NIBP numeric displays will indicate the reading of the previous measurement taken and the Message Window will display the time stamp of that reading.

NOTE:
Pressing the CYCLE pushbutton during the Manual, Automatic or STAT Modes will terminate the current NIBP measurement (if active) and place the monitor in the Automatic Cycle mode. The user will then be allowed to alter the Cycle time, if necessary, and begin a new NIBP measurement.

WARNING:
When monitoring over an extended period of time, or at frequent intervals, periodically observe the patient’s limb to make sure that the circulation is not impaired for a prolonged period of time.

HISTORY MODES

The History Mode allows the user to recall previously taken measurements. The measurement results and the time the measurement was taken are also displayed.

Patient History is organized in two visually displayed lists.

Event History: Pressing the HISTORY pushbutton the first time reveals the first viewable list that contains up to 480 entries of NIBP Event History readings along with the corresponding %SpO_2 results (Model 9402).

Trend History: Pressing the HISTORY pushbutton again reveals the second viewable list that contains up to 480 entries of Trend History at one (1) minute intervals. The Trend History contains all the events from the Event History log combined with a one (1) minute average of the SpO_2 values (Model 9402) that are saved every minute.

NOTE:
Both Event and Trend History data are only available for twenty-four (24) hours. Data older than twenty-four (24) hours is automatically removed from the History lists.

Once the HISTORY pushbutton has been pressed, use the HISTORY pushbutton to toggle between the two History menus.

When completed, press the CANCEL pushbutton to return to "Ready" or after thirty (30) seconds of button inactivity the monitor will automatically return to "Ready".

NOTE:
History data values for NIBP are saved as they occur. History data values for %SpO_2 are saved once a minute (one (1) minute average).

NOTE:
Turning the power “OFF” does not clear the History memory. Measurements will remain in memory for up to twenty-four (24) hours. Any measurement older than twenty-four hours is deleted. It is suggested to manually clear History between patients (See CLEARING HISTORY on Page 59).

EVENT HISTORY (EVENT-Ev)

To review History based on Event readings, press the HISTORY pushbutton. The most current NIBP measurement and the time of measurement (HH:MM-Ev) are displayed on the front panel along with its corresponding %SpO_2 values. If there are no readings in the History, the message "No Evnts" is displayed in the Message Window.

Press the ARROW DOWN pushbutton to review preceding measurements. The word "Oldest" will be displayed briefly on the Message Window when there are no more readings left in the memory. The oldest measurement will then be redisplayed.

Press the ARROW UP pushbutton to advance the measurements towards the most current measurement taken. The word "Newest" will be displayed briefly on the Message Window when there are no more current readings. The most recent measurement will then be redisplayed.

To exit the History Mode and return to "Ready" press the CANCEL pushbutton. If a measurement is desired immediately while in the History Mode, simply press START. This will exit the History Mode and begin a measurement.

TREND HISTORY (TREND-Tr)

NOTE:
For the Model 9401, no Trend History menu will be available.

To review Trend History, press the HISTORY pushbutton twice. The most current measurement (NIBP or a one (1) minute averaged %SpO_2) values and the time of measurement (HH:MM-Tr) are displayed on the front panel. If there are no readings in the History, the message "No Trend" is displayed in the Message Window.

Press the ARROW DOWN pushbutton to review preceding measurements. The word "Oldest" will be displayed briefly on the Message Window when there are no more readings left in the memory. The oldest measurement will then be redisplayed.

Press the ARROW UP pushbutton to advance the measurements towards the most current measurement taken. The word "Newest" will be displayed briefly on the Message Window when there are no more current readings. The most recent measurement will then be redisplayed.

To exit the History Mode and return to "Ready" press the CANCEL pushbutton. If a measurement is desired immediately while in the History Mode, simply press START. This will exit the History Mode and begin a measurement.

NOTE:
Turning the power “OFF” does not clear the History memory. Measurements will remain in memory for up to twenty-four (24) hours. Any measurement older than twenty-four hours is deleted. It is suggested to manually clear History between patients (See CLEARING HISTORY on Page 59).

PRINT HISTORY (to optional printer)

The stored Event History and Trend History data are printed individually. Press and Hold the HISTORY pushbutton for two (2) seconds while in either the Event or Trend History screens.

The message “Print? N” appears in the Message Window.

Use either the ARROW UP or ARROW DOWN pushbutton until the message “Print? Y” appears in the Message Window.

Press the HISTORY pushbutton again to start printing the History data. The message “Printing” appears in the Message Window as a status indicator.

NOTE:
Prior to accessing the Print History mode, the printer should have paper installed and the power turned “ON”. Refer to Section 8 for more information about printing and sample printouts of both History screens.

CLEARING HISTORY

The History data can be manually cleared by pressing and holding for two (2) seconds the HISTORY pushbutton while in either of the History modes. The message “Print? N” appears in the Message Window.

Press the HISTORY pushbutton again and the message “Erase? N” appears in the Message Window.

Use either the ARROW UP or ARROW DOWN pushbutton until the message “Erase? Y” appears in the Message Window.

Pressing the HISTORY pushbutton a final time and the message “Erasing” appears in the Message Window. The monitor erases the memory, exits the History mode and returns to the “Ready” state.

REAL TIME CLOCK (RTC)

The CARDELL Monitor uses an internal Real Time Clock to time stamp all entries that are stored in History. Changes made to either the time or date settings should be performed in-between patients being monitored. Refer to Page 53, DISPLAYING THE TIME and Page 71, SETTING THE TIME for more information.

PATIENT ALARM MODE

WARNING:
Configuring the CARDELL Monitor's alarm settings to "OFF" will disable all audible and visual alarms. This mode should only be selected for spot check applications where the patient is receiving bedside surveillance by a trained clinician. Refer to Page 68, AUDIO ALARMS (SILENCE/RESET Pushbutton) for more information.

The CARDELL Monitor is equipped with patient alarms to warn the user if any measurement parameter is outside the range of a user set value. This feature will allow the user to set values for:

Systolic High and Low
Diastolic High and Low
MAP High and Low
Pulse High and Low
%SpO_2 High and Low (Model 9402)

CHANGING ALARM LIMITS

The CARDELL Monitor incorporates a two (2) step process for reviewing and changing Alarm Limit values.

Press the ALARM LIMITS pushbutton once and the monitor's front panel displays indicate the current values of all High Alarm Limit values, for two (2) seconds then toggles to indicate all Low Alarm Limit values for two (2) seconds. This reviewing of all High and Low Alarm Limit values continues for thirty (30) seconds if no other pushbutton is pressed.

To change the value of an Alarm Limit, press the ALARM LIMITS pushbutton again. The Alarm Limit value is displayed in its corresponding display window and the Message Window will display the limit's name.

Use the ARROW UP or ARROW DOWN pushbuttons to change the limit value. Use the ALARM LIMITS pushbutton key to advance onto the next parameter value.

Press the CANCEL pushbutton to return to "Ready" or after thirty (30) seconds of button inactivity the monitor will automatically return to "Ready". The alarm value(s) set will now be used until power is turned "OFF".

SAVING ALARM LIMITS

To save the Alarm Limit values to non-volatile memory, press and hold the ALARM LIMITS pushbutton for two (2) seconds while in the Alarm Limits set value mode. The Message Window will display "Save? N".

Press either the ARROW UP or ARROW DOWN pushbuttons will display "Save? Y" in the Message Window. Press the ALARM LIMIT pushbutton a final time.

The Message Window will display “Saving” and the current value(s) will be saved. When finished, press the CANCEL pushbutton to return to the “Ready” state. These values will be retained in memory even after the monitor is turned “OFF”.

RESTORE FACTORY DEFAULTS

To restore the factory default settings, press ALARM LIMITS pushbutton to enter the Alarm Limits mode.

Press and Hold the ALARM LIMITS pushbutton for 2 seconds until the message “Saving? N” appears in the Message Window.

Press the ALARM LIMITS pushbutton to bring up the Recall menu. The message “Recall? N” appears in the Message Window. Pressing either the ARROW UP or ARROR DOWN pushbutton will display the message “Recall? Y” in the Message Window.

Press the ALARM LIMITS pushbutton. The Message Window will display "Restore" and return to the Alarm Limit menu. When finished, press the CANCEL pushbutton to return to the “Ready” state.

ALARM LIMIT VALUES

Table 4, lists the Alarm Limit Default Values used by the CARDELL Monitor.

Table 4: **Default Alarm Values**

	Systolic	Diastolic	MAP	Pulse	%SpO_2
High	240	130	220	290	OFF
Low	OFF	OFF	OFF	OFF	88

NOTE:
Patient alarms for Systolic, Diastolic and MAP values are produced at the time the measurement is taken. Alarms for %SpO_2 have a ten (10) second delay. Alarm for Pulse Rate will be immediate if taken from the NIBP or have a ten (10) second delay if taken from the SpO_2 signal.

AUDIBLE AND VISUAL INDICATORS

The CARDELL Monitor is capable of producing both an audible and a visual indicator for a variety of monitor conditions. The following table provides a cross reference for audible and visual indications.

Table 5: **Audible and Visual Indicators**

Alarm Condition	Priority Level	Audible Tone	Visual Indication
Dead Battery	High	3 Beeps followed by 2 Beeps every 10 seconds	The message is displayed continuously in the Message Window. The Battery Power Visual Indicator is Red.
Patient Alarm Limit Violations	High	3 Beeps followed by 2 Beeps every 10 seconds	The associated 7-segment LED flashes for one second on / one second off for the parameter limit in violation.
SpO_2% Alarm Limit Violations			The message is displayed for one second every two to six seconds in the Message Window *.
Power Fail	High	3 Beeps followed by 2 Beeps every 10 seconds	The message is displayed for one second every two to four seconds in the Message Window *.
Low Battery Alarm	Medium	3 Beeps every 25 seconds	The message is displayed for one second every two to six seconds in the Message Window *. The Battery Power Visual Indicator is Red.
NIBP Application Error	Medium	3 Beeps every 25 seconds	The message is displayed for one second every two to six seconds in the Message Window *.
SpO_2 Probe Alarms	Medium	3 Beeps every 25 seconds	The message is displayed for one second every two to six seconds in the Message Window *.
NIBP Complete	Low	1 Beep when blood pressure is completed	Numerics are updated with each blood pressure taken.
SpO_2 Pulse Beat	Low	1 Beep coincides with each received SpO_2 pulse rate	Numerics are updated with each received SpO_2 pulse rate value.
Key Click	Low	1 Beep associated with each button action	None

***** - The message interval time will vary based on what monitor conditions are present.

NOTE:
Refer to Table 7, on Page 76 for a listing of messages that may be displayed in the Message Window.

CLEARING ALARMS

The CARDELL Monitor provides to the user with an audible and visual indication for both patient and equipment alarm conditions.

NIBP PATIENT ALARMS

During an active NIBP Patient Alarm Limit Violation (Low/High Systolic or Low/High Diastolic), the monitor flashes the LED display of the parameter in alarm and provides a Patient Alarm Limit Violation audible tone.

To acknowledge the alarm, press the SILENCE/RESET pushbutton.

The monitor silences the audible tone and the parameter in alarm stops flashing.

HIGH / LOW %SpO_2 ALARMS

During either a High or Low %SpO_2 Alarm Limit Violation, the monitor flashes the %SpO_2 LED display, provides a Patient Alarm Limit Violation audible tone and displays the appropriate message (SpO_2 Hi or SpO_2 Lo) in the Message Window.

To acknowledge the alarm and temporarily mute the audio, press the SILENCE/RESET pushbutton.

The monitor silences the audible tone for a maximum of fifteen (15) seconds, the parameter in alarm continues to flash on the front panel and the appropriate message will be displayed in the Message Window. If the current patient alarm condition becomes inactive during the 15 seconds and then recurs OR a different patient alarm condition occurs during the 15 seconds, the audio alarm is reactivated. If the alarm condition continues uninterrupted for the 15 seconds, the audio alarm is reactivated.

SpO_2 PULSE RATE ALARM

During a SpO_2 Pulse Rate Alarm Limit Violation, the monitor flashes the ♥ BPM LED display and provides a Patient Alarm Limit Violation audible tone.

To acknowledge the alarm and temporarily mute the audio, press the SILENCE/RESET pushbutton.

The monitor silences the audible tone for a maximum of fifteen (15) seconds and the parameter in alarm continues to flash on the front panel. If the current patient alarm condition becomes inactive during the 15 seconds and then recurs OR a different patient alarm condition occurs during the 15 seconds, the audio alarm is reactivated. If the alarm condition continues uninterrupted for the 15 seconds, the audio alarm is reactivated.

EQUIPMENT ALARMS

During an Equipment Alarm, the monitor displays the alarm parameter in either the Message Window or flashes the LED display of the alarmed parameter and provides an audible Alarm Tone. To clear the alarm, press the SILENCE/RESET pushbutton. The monitor silences the audible tone and clears the parameter.

NOTE:
The Low Battery and Dead Battery alarms cannot be silenced.

ADJUSTING THE AUDIO ALARM VOLUME

The Alarm Volume can be adjusted to one (1) of five (5) volume levels. Press the AUDIO pushbutton. The Message Window displays the current value of the Audio Alarm Volume "ALARM".

Use the ARROW UP and ARROW DOWN pushbuttons to adjust the volume level desired. Altering the Alarm Volume will produce a single tone at the selected volume level.

Press the CANCEL pushbutton when completed.

NOTE:
The Volume Level cannot be set to "OFF".

NOTE:
No "Key Click" will be heard when the Audio Volume is set to a MINIMUM setting.

ADJUSTING THE SpO_2 "BEEP" VOLUME

(Model 9402 only)

The Volume for the SpO_2 "Beep" can be adjusted to one (1) of five (5) levels and "OFF". This setup menu follows directly after the Audio Alarm Volume. Press the AUDIO pushbutton until the Message Window displays the SpO_2 Volume message "SpO2".

Use the ARROW UP and ARROW DOWN pushbuttons to adjust the volume level desired. Altering the SpO_2 Volume will produce a single tone at a selected "non-off" volume level.

Press the CANCEL pushbutton when completed.

2-MINUTE AUDIO SILENCE

NOTE:
Enabling the 2-Minute Audio Alarm Off mode can only be accomplished after all active alarm conditions have been addressed. To clear an alarm, refer to Page 63, CLEARING ALARMS for more information.

If the 2-Minute Audio Off mode is selected in the Monitor Configuration menu (refer to section MONITOR CONFIGURATION), pressing the SILENCE/RESET pushbutton will temporarily deactivate the audio alarms for two (2) minutes. The visual indicator next to the SILENCE/RESET pushbutton will illuminate continuously and the message “2Min Aud” will be displayed in the Message Window as a reminder.

NOTE:
If the Message Window is currently displaying a time stamp from a previously taken NIBP measurement, the “2Min Aud” message will alternately be displayed with the time stamp message.

When the 2-Minute Audio Off is enabled, the monitor will not alarm for patient related High and Low alarms, NIBP Application Error and SpO_2 Probe Alarm. The monitor will alarm for Low Battery and Dead Battery.

To re-activate the audio alarm, press the SILENCE/RESET pushbutton again. The visual indicator will go out. If the button is not pressed, audible alarms will be re-armed automatically after two (2) minutes. Refer to Page 68, AUDIO ALARMS (SILENCE/RESET Pushbutton) for more information.

PERMANENT AUDIO ALARM SILENCE

NOTE:
Enabling the Permanent Audio Alarm Off mode can only be accomplished after all active alarm conditions have been addressed. To clear an alarm, refer to Page 63, CLEARING ALARMS for more information.

If the Permanent Audio Off mode is selected in the Monitor Configuration menu (refer to section MONITOR CONFIGURATION), pressing the SILENCE/RESET pushbutton will deactivate the audio alarms. The visual indicator next to the SILENCE/RESET pushbutton will flash at a rate of one (1) second “ON” and one (1) second “OFF” and the message “Perm Aud” will be displayed in the Message Window as a reminder.

NOTE:
If the Message Window is currently displaying a time stamp from a previously taken NIBP measurement, the “Perm Aud” message will alternately be displayed with the time stamp message.

When enabled, the monitor will not alarm for patient related High and Low alarms, NIBP Application Error and SpO_2 Probe Alarm. The monitor will alarm for Low Battery and Dead Battery.

To re-activate the audio alarm, press the SILENCE/RESET pushbutton again. The visual indicators will go out. Refer to Page 68, AUDIO ALARMS (SILENCE/RESET Pushbutton) for more information.

ALARM LIMITS OFF

If the Alarm Limits Off mode is selected in the Monitor Configuration menu, all alarms associated with patient alarms are “OFF” except for Low Battery and Dead Battery. The visual indicator next to the SILENCE/RESET pushbutton will flash at a rate of two (2) second “ON” and two (2) seconds “OFF” and the message “Alrm Off” will be displayed in the Message Window as a reminder.

NOTE:
If the Message Window is currently displaying a time stamp from a previously taken NIBP measurement, the “Alrm Off” message will alternately be displayed with the time stamp message.

To re-activate the audio alarms, refer to Page 68, AUDIO ALARMS (SILENCE/RESET Pushbutton) for more information.

MONITOR CONFIGURATION

The Monitor Configuration section allows the user to configure the CARDELL Monitor to your individual needs. Once entered, the user can:

- Review the monitor's internal Software Revisions
- Select the Operating Language
- Make selections for Audio Alarms
- Choose to display the MAP value
- Set the SpO_2 Alarm Delay
- Set the Date
- Set the Time
- Set Daylight Saving Time Option
- Perform System Checks (Refer to Page 93, NIBP CALIBRATION CHECK)
  - Manometer Mode
  - Leak Check

ENTERING THE CONFIGURATION MENU

To enter the monitor's Configuration Menu, press and hold the VOLUME and ALARM LIMITS pushbutton keys while the monitor is being turned "ON" .

Once in the menu, use one of the *NEXT* (HISTORY / AUDIO) or *PREVIOUS* (CYCLE TIME / ALARM LIMITS) programmed pushbutton keys to advance onto the next or go back to the previous parameter in the Configuration Menu.

NOTE:
While in the Configuration Menu, if no pushbutton is pressed within 60 seconds, the monitor will automatically save all changes made and exit the Monitor Configuration menu. The Message Window will briefly display "Saving" and return to the "Ready" mode.

SAVING YOUR CHANGES

When you have completed configuring the monitor, press the CANCEL pushbutton to exit and lock in your selection(s). The Message Window will briefly display "Saving" and return to the "Ready" mode.

SOFTWARE REVISIONS

The CARDELL Monitor displays the current software revision of its operating system and that of the internal modules being used inside. The software versions are displayed in the following order:

Table 6: **Software Revisions**

Software Module	Message Window
CARDELL Monitor Control Board	Ver X.X
Boot Loader	Boot X.XX
Power Supply PIC Processor	PIC X.X
CAS NIBP Module	ND X.X
Nellcor SpO_2 Module (1)	NEL X.X

Use the ARROW UP or ARROW DOWN pushbuttons to view the messages.

Press one of the *NEXT* programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the “Ready” mode.

SETTING THE LANGUAGE

The CARDELL Monitor can operate in one (1) of ten (10) languages: English, German, French, Italian, Spanish, Dutch, Swedish, Portuguese, Norwegian or Danish.

To configure the monitor’s operating language, first enter the Monitor Configuration menu. Once in the menu, use one of the *NEXT* programmed pushbutton keys until the Message Window displays the current language being used.

Use the ARROW UP or ARROW DOWN pushbuttons to make your selection.

Press one of the *NEXT* programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the “Ready” mode.

AUDIO ALARMS (SILENCE/RESET Pushbutton)

The CARDELL Monitor’s SILENCE/RESET pushbutton can be configured to have the audio associated with patient alarms set to one of three selections. The selections are:

- 2-Minute Audio Alarm Off (Default)
- Permanent Audio Alarm Off
- Alarm Limit Off

(1) In the Model 9401 monitor, this message is skipped.

To configure the alarms, first enter the Monitor Configuration menu. Once in the menu, use one of the *NEXT* programmed pushbutton keys until the Message Window displays the current value of the Audio Alarms menus.

Use the ARROW UP or ARROW DOWN pushbuttons to make your selection.

Press one of the *NEXT* programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the “Ready” mode.

2-MINUTE AUDIO ALARM OFF

When the monitor is configured for the 2-Minute Audio Alarm Off setting, use the SILENCE/RESET pushbutton to “enable or disable” audio alarms for a two (2) minute period. The SILENCE visual indicator, located on the front panel of the monitor will be illuminated constantly and the message “2Min Aud” will be displayed on the Message Window as a reminder when enabled. At the end of two (2) minutes, the monitor will automatically exit the 2-Minute Audio Alarm Off setting and return to normal operation.

During a two-minute silence period, if an alarm (patient or equipment) occurs, except for Low Battery and Dead Battery, the audio alarm remains silenced for the remainder of the two-minutes and only a visual indicator is provided.

PERMANENT AUDIO ALARM OFF

When the monitor is configured to the Permanent Audio Alarm Off setting, use the SILENCE/RESET pushbutton to “enable or disable” audio alarms. The SILENCE visual indicator, located on the front panel of the monitor will flash at a rate of one (1) second “ON” and one (1) second “OFF” and the message “Perm Aud” will be displayed on the Message Window as a reminder when enabled.

During a permanent audio alarm off period, if an alarm (patient or equipment) occurs, except for Low Battery and Dead Battery, the audio alarm remains silenced and only a visual indicator is provided.

ALARM LIMIT OFF

When the monitor is configured to the Alarm Limit Off setting, all alarms associated with patient alarms are “OFF”. Also, when a NIBP measurement is started using the Manual mode, the inflation pressure will always be set to 150 mmHg.

This mode is useful for spot check applications or if the monitor is being moved from patient to patient and the user may not want to be disturbed by any audible alarms.

The SILENCE visual indicator, located on the front panel of the monitor will flash at a rate of two (2) seconds “ON” and two (2) seconds “OFF” and the message “Alrm Off” will be displayed on the Message Window as a reminder when enabled.

During an alarm limit off period, if an equipment alarm occurs, except for Low Battery and Dead Battery, the audio alarm remains silenced and only a visual indicator is provided.

MAP VALUE ENABLE / DISABLE

During a blood pressure reading, the user can elect to display or not to display the MAP value.

Should it need to be changed, first enter the Configuration menu. Refer to Page 67, ENTERING THE CONFIGURATION MENU. Once in the menu, use one of the NEXT programmed pushbutton keys until the Message Window displays the monitor's current setting for the MAP value "MAP On" or "MAP Off".

Use the ARROW UP or ARROW DOWN pushbuttons to make your selection.

NOTE:
When "MAP Off" is selected, MAP values are omitted from History Display and Printing as well. All alarms associated with MAP values are also disabled.

Press one of the NEXT programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the "Ready" mode.

SET THE SpO_2 ALARM DELAY

The delay time until an alarm is generated for $\%SpO_2$ and Pulse Rate can be configured to be either zero (0) seconds "Delay 0S" or ten (10) seconds "Delay10S". The default value used by the CARDELL Monitor is ten (10) seconds.

Use the ARROW UP or ARROW DOWN pushbuttons to make your selection.

Press one of the NEXT programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the "Ready" mode.

SETTING THE DATE

The CARDELL Monitor's Date value is set at the factory. Should it need to be changed, enter the Monitor Configuration menu and use one of the *NEXT* programmed pushbutton keys until the Message Window displays the monitor's date using the following format: "DDMMMYY". Where DD = Day of the Month, MMM = Month of the Year (Jan, Feb, etc.) and YY = Last 2 digits of the year (2002 is displayed as 02). The flashing parameter indicates the parameter that can be changed.

Use the ARROW UP or ARROW DOWN pushbuttons to make your selection. Press one of the *NEXT* programmed pushbutton keys to advance to the next parameter to set within the Date menu.

Press one of the *NEXT* programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the "Ready" mode.

SETTING THE TIME

The CARDELL Monitor's Time value is set for Eastern Time and is set at the factory. Should it need to be changed, enter the Monitor Configuration menu and use one of the *NEXT* programmed pushbutton keys until the Message Window displays the monitor's time using the following format: "HH:MM". Where HH = Hour of the Day (0 – 23) and MM = Minute of the Hour (0 – 59). The flashing parameter indicated the parameter that can be changed.

Use the ARROW UP or ARROW DOWN pushbuttons to make your selection. Press one of the *NEXT* programmed pushbutton keys to advance to the next parameter to set within the Time menu.

NOTE:
Altering the Date and Time will affect the History readings, but not erase them.

Press one of the *NEXT* programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the "Ready" mode.

DAYLIGHT SAVING TIME OPTION

The CARDELL Monitor can be configured to automatically respond to time changes associated with Daylight Saving Time. The monitor can be configured to one of five Daylight Saving Time Option settings. They are:

- DST OFF — Daylight Saving Time is "OFF". The user is responsible for changing the time if needed. This is the default setting for the monitor.
- DST N AM — Daylight Saving Time "North America". Use this setting and the monitor will automatically change time accordingly to the Daylight Saving Time for countries in North America.
- DST EU 1 — Daylight Saving Time for all European countries using Greenwich Mean Time.
  - DST EU 2 — Daylight Saving Time for all European countries 1 hour ahead of Greenwich Mean Time.
  - DST EU 3 — Daylight Saving Time for all European countries 2 hours ahead of Greenwich Mean Time.

NOTE:
Enabling Daylight Saving Time will affect the History readings, but not erase them.

Press one of the *NEXT* programmed pushbutton keys to advance onto the next menu or use the CANCEL pushbutton to exit to the "Ready" mode.

BATTERY POWER

The CARDELL Monitor is equipped with an internal rechargeable battery. The battery is charging whenever the monitor is plugged into the AC wall outlet. A Battery Power Visual Indicator, located on the front panel, indicates the status condition of the monitor's battery.

Batteries will self-discharge when they are not used. It is recommended that the battery be maintained at full charge by leaving the monitor connected to the AC wall outlet whenever possible.

The standard 7.2 Volt 3700 mAhr battery pack, when fully charged, is capable of taking 100 NIBP readings when the monitor is in the 5-minute Automatic Mode.

When the message "Low Batt" appears in the Message Window, at least thirty (30) minutes of battery operation remain. The "Low Batt" message will alternate continuously with the "Ready" message to indicate that the battery should be charged as soon as possible. Also, the monitor's front panel Battery Power Visual Indicator will change from Orange to Red and three (3) audio "beeps" are heard every twenty-five (25) seconds.

WARNING:
Upon the detection of a Low Battery condition and if the battery is not charged by the user, the monitor may no longer function as intended. The monitor should be plugged into an AC wall outlet as soon as possible and the battery allowed to charge for four (4) hours.

When the "Dead Bat" message appears, the battery is no longer able to power a measurement. The message "Dead Bat" is displayed continuously in the Message Window, the Battery Power Visual Indicator is colored Red and three (3) audio "beeps" followed by two (2) audio "beeps" once every ten (10) seconds are heard until the power is turned off.

WARNING:
Upon the detection of a Dead Battery condition and if the monitor is not turned off by the user, the monitor shuts down and turns "OFF" after three (3) minutes of operations.

When either of these messages appears, it is necessary to recharge the battery. A depleted battery may be fully recharged in four (4) hours. The monitor can be used to obtain measurements while the battery is charging.

NOTE:
Using the monitor while charging may lengthen the time to restore battery charge.

NOTE:
During charging of the battery, the case may feel warm to the touch.

CHECKING BATTERY STATUS

NOTE:
The monitor, when connected to AC Line Power and is powered "OFF", will display "CHARGING" in the Message Window until the battery reaches a full charge condition. Once the battery reaches full charge, the monitor is capable of supplying battery charge information as described below.

The monitor's Main Board receives information from electronics enclosed within the battery pack. The status of the battery pack can be verified using one of the following methods:

1) When the monitor is connected to AC Line Power and is powered "ON", press and hold the SILENCE/RESET pushbutton for two (2) seconds. The monitor will display in the Message Window, for as long as the button is pressed, "XXX % CHG", where "XXX" represents the percent (0 to 100) of the full charge condition of the battery.

2) When the monitor is connected to AC Line Power and is powered "OFF", the Message Window will display "XXX % CHG", where "XXX" represents the percent (0 to 100) of the full charge condition of the battery.

3) When the monitor is running on battery power and is powered "ON", press and hold the SILENCE/RESET pushbutton for two (2) seconds. The Message Window will display, for as long as the button is pressed, "XXX % CHG", where "XXX" represents the percent (0 to 100) of the full charge condition of the battery.

CAUTION:
This product contains a rechargeable battery that is recyclable. Under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local authorities for instructions on recycling options in your area.

AUTO OFF FEATURE

The CARDELL Monitor incorporates an Auto "OFF" feature to preserve battery life. The Auto Off feature is enabled automatically when the user selects the "Alrm Off" option in the Configuration Menu.

When the monitor is in this mode and if accidentally left powered "ON" for ten (10) minutes without any key presses or any parameters active, the monitor will beep for five (5) seconds prior to automatically shutting itself down to preserve battery life.

For the Auto “OFF” feature to work properly, the following conditions must apply;

- Alrm Off is selected in the Configuration Menu.
- The CARDELL Monitor is operating on battery power.
- No NIBP or SpO_2 readings were taken in the past ten (10) minutes.
- No key presses were made in the past ten (10) minutes.
- The monitor cannot be in the Automatic NIBP cycle mode.

POWER FAIL

The CARDELL Monitor incorporates a Power Fail feature. Whenever the power is disconnected from the monitor and the monitor is not allowed to shut down in an orderly fashion, the monitor, when re-powered alerts the user. The message “Pwr Fail” is displayed in the Message Window and three (3) audio “beeps” followed by two (2) audio “beeps” are heard every ten (10) seconds. During this condition, all other pushbuttons are inactive except for the POWER and SILENCE/RESET.

To clear the Power Fail condition, and return to “Ready”, press the SILENCE/RESET pushbutton or properly recycle the monitor’s power.

USER MESSAGES

The CARDELL Monitor displays a variety of messages to aid the user in monitor operation. If a troubleshooting message is displayed during a measurement, follow the actions listed to correct the situation.

If the monitor does not turn on, or exhibits a flashing display and failure to operate, the battery is most likely below the Dead Battery point. Connect the monitor to an AC wall outlet and allow it to charge for four (4) hours.

Refer to Table 7, Error Messages on the Message Window for more information.

If the monitor is in need of repair, it must be referred to the appropriate service personnel. Service performed by unauthorized personnel could be detrimental to the monitor and will void the warranty. For service, contact CAS Medical Systems, Inc.

SpO_2 USER MESSAGES
(Model 9402 only)

If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by an alternate method.

NOTE:
The SpO_2 probe must be kept as motionless as possible to make a proper determination. Use the SpO_2 strength bar graph to determine if a strong rhythmic pulse signal is present.

When no oximeter probe is attached to the monitor, the %SpO_2 window and signal strength window will be blank. When no SpO_2 pulse data is available, the monitor will display the last NIBP pulse.

When the probe is connected to the monitor, but is off of the patient, the message "- -" is displayed in the %SpO_2 and Pulse Rate windows. The Message Window flashes the message "Prb OFF" and three (3) audio "beeps" are heard every twenty-five (25) seconds.

Press the SILENCE/RESET pushbutton. The monitor silences the audible alarm tone, but the message remains.

If the message "Prb" should appear in the %SpO_2 window, verify that the probe being used is not defective by replacing the defective one and trying a different probe.

If the SpO_2 Module located inside the CARDELL Monitor should fail, the message "Err" will appear in the %SpO_2 display window. Press the SILENCE/RESET pushbutton. The monitor silences the audio alarm tone, but the message remains.

Should the problem persist, contact CAS Medical Systems, Inc.

ERROR MESSAGES ON THE MESSAGE WINDOW

Table 7: **Error Messages on the Message Window**

ERROR MESSAGE	POSSIBLE CAUSE	POSSIBLE SOLUTION
"Air Leak"	Cuff applied too loosely. Leak in cuff/monitor pneumatic system.	Check cuff for snug fit on patient. Check that the cuff/monitor connection is secure. Check cuff for leaks. Do not use a known leaky cuff.
“Appl Err“	Small Cuff is detected in Large Cuff Mode.	Check cuff. Replace cuff or change operating mode.
“ChksumEr“	An electronic failure has occurred within the monitor’s Main Control Board.	Contact CAS Medical Systems, Inc. to have the monitor serviced.
"Dead Bat"	The battery is fully discharged.	Recharge the battery for at least 4 hours.
"Flow Err"	Stable cuff pressure cannot be maintained by the pneumatic system.	Check the external tube for kinks. Perform a Pneumatic Check as detailed in the Maintenance section of this manual. Replace cuff.
"LooseCuf"	Cuff applied too loosely.	Check cuff for proper fit on patient.
"Low Batt"	The battery is almost discharged.	At least 30 minutes of operation are available from when the message first appears. Recharge the battery as soon as possible.
"Motion"	There was too much extremity motion for the monitor to accurately complete the measurement in 120 seconds.	Measurements can be obtained when there is limited extremity movement, but the measurement time may be extended. Measurement time is limited to 120 seconds. Restrain patient extremity motion.
"NBP Cal"	Pressure calibration data corrupted within NIBP module.	Pressure module needs recalibration. Contact CAS Medical Systems, Inc. to have the monitor serviced.

ERROR MESSAGES ON THE MESSAGE WINDOW (cont.)

Table 7: **Error Messages on the Message Window**

ERROR MESSAGE	POSSIBLE CAUSE	POSSIBLE SOLUTION
"NIBP Err"	An electronic failure has occurred within the NIBP module.	Contact CAS Medical Systems, Inc. to have the monitor serviced.
“No Probe”	The monitor is not detecting the SpO_2 probe.	The probe was disconnected.
"OverPres"	Cuff pressure exceeded 290 mmHg.	Very rapid squeezing of the cuff can cause this error. Repeat the measurement. If this message repeatedly occurs during normal use, the monitor must be serviced.
“P Search”	The monitor is searching for a Pulse signal.	Normal at power-up as the monitor searches for a pulse. The probe position may have changed. Check the probe site.
“Prb OFF”	The monitor is no longer receiving a patient signal from the probe.	The probe is no longer in contact with the patient. Check the probe site.
"Pwr Fail"	Power was disconnected from the monitor.	Press the SILENCE/RESET pushbutton to clear the message. OR Re-cycle the monitor’s power.
"RangeErr"	The systolic reading exceeds the measurement range of 265 mmHg.	Repeat measurement. If the message is displayed again, use another method to measure the patient’s blood pressure.
“SetClock”	The monitor’s clock needs to be set.	The monitor’s time and date values are incorrect. Refer to Page 70 and for information to set the Time and Date. The monitor’s internal clock battery needs to be replaced. Contact CAS Medical Systems.

ERROR MESSAGES ON THE MESSAGE WINDOW (cont.)

Table 7: **Error Messages on the Message Window**

ERROR MESSAGE	POSSIBLE CAUSE	POSSIBLE SOLUTION
“Sig Sat”	Motion pulses too strong.	Limit patient activity. Repeat measurement.
"Time Out"	The monitor was unable to complete a measurement within 150 seconds.	An extremely long measurement can be due to a loose cuff, high blood pressure, or monitor re-pumps. Try measurement again. Try higher initial pressure. If message consistently reappears try using another means to obtain patient's blood pressure.
"Weak Sig"	The monitor did not detect any pulses during a NIBP measurement.	Check the fit of the cuff. Repeat measurement.

8. EXTERNAL PRINTER (optional)

The following section is provided as an overview of the Citizen CMP-10 Mobile Printer as it is used with the CARDELL Monitor.

NOTE:
The Citizen Model CMP-10 Mobile Printer that is used with the CARDELL Monitor has proprietary software installed in it for communications.

NOTE:
For more detailed information on the Citizen Model CMP-10 Mobile Printer, refer to the User's Manual that was supplied with the printer.

WARNING:
The CARDELL Monitor has been tested with the Citizen CMP-10 Mobile printer to comply with IEC 60601-1-1 and is the only printer that is recommended to be used with the monitor. If another printer is to be used, the user must read the Warning on Page 29 under LEAKAGE CURRENT TEST and follow the guidance given.

PRINTER OVERVIEW

The Citizen CMP-10 Mobile Printer interfaces to the CARDELL Monitor via an infrared IrDA port or by using the direct connect RS232 cable (supplied with printer). The IrDA ports are located on the top of the printer and on the bottom front panel of the CARDELL Monitor.

When using the IrDA port, it is important to keep the two devices close together (less than three (3) feet/one (1) one meter) and in-line to maintain proper communications.

NOTE:
The CARDELL Monitor must be equipped with the RS232 Communication Module (optional).

CAUTION:
For safe and proper usage of the external printer, please observe the following:

When using the printer:

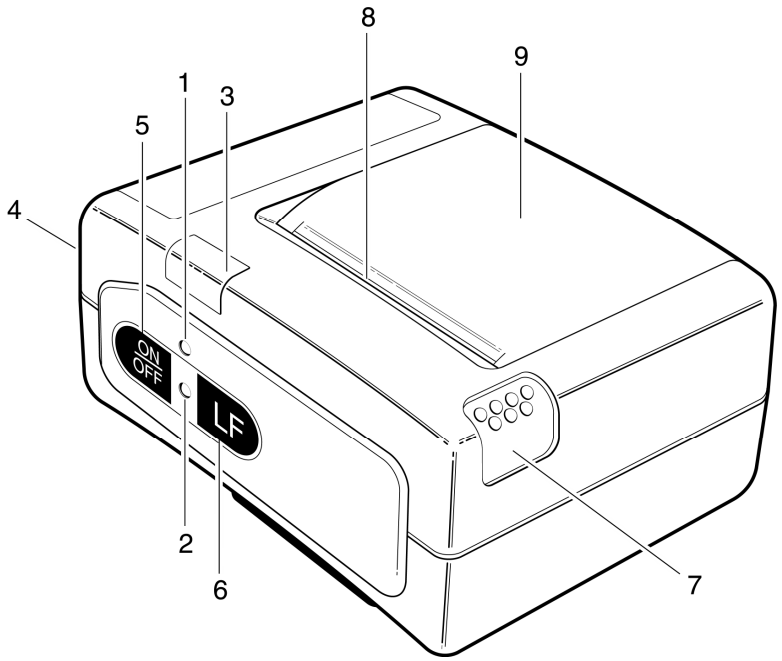
- Avoid placing monitor in areas where fluid may enter the printer opening accidentally.
- Do not drop or bump the monitor.
- Avoid places subject to high or low temperature extremes.
- Avoid direct sunlight.
- Avoid dusty places and where corrosive gasses are generated.
- Never attempt to dismantle or repair the printer mechanism.

When handling the thermal paper:

- Store in a dark, cool and dry place.
- Do not place near organic solvents.
- Avoid contact with vinyl chloride films erasers or adhesive tapes for extended periods.
- Avoid exposure to high temperature, humidity, liquid, or sunlight.
- Always use specified thermal paper (CAS P/N 28-02-0077).

PRINTER CONTROLS AND INDICATORS

Figure 11: **Printer Controls and Indicators**



- LED Indicators (Bicolor – Red and Green)

1. CHARGE LED
   Red on – Charging Battery
   Green on – Battery is fully charged

2. Power (Error) LED
   Green on – Device is switched “ON” or self-testing is in progress
   Red/Green blinking fast - End of paper
   Red/Green blinking slow - Print Head Overheated

- Controls

3. Infrared (IrDA) port
4. RS 232 Serial Port
5. Power ON/OFF switch
6. Line Feed button press once for one (1) line paper feed
   press down and hold for continuous paper feed to any length
7. Paper Cover Release Button – Press down to open cover
8. Paper Cutting Edge
9. Paper Cover

PRINTER OPERATION

DIRECT CONNECTION

The monitor uses the optional DB9 connector, located on the rear panel of the monitor to interface to the RS232 port on the printer. Use the cable which is supplied with the printer.

NOTE:
When using the direct connect method, connect the printer's serial cable to the printer before turning the printer on.

INFRARED CONNECTION

NOTE:
When using the infrared port, disconnect the printer's serial cable from the printer before turning the printer on.

Position the printer's IrDA port window in-line with the IrDA window of the CARDELL Monitor OR connect the RS232 direct cable from the printer to the 9-pin RS 232 connector, located on the rear panel of the CARDELL Monitor.

NOTE:
When using the IrDA port for printing, it is recommended to keep all items clear of the communications path between the monitor and the printer.

Turn the printer "ON". To turn the printer "ON", press and hold the ON/OFF pushbutton for one (1) second. The Power LED illuminates Green.

To turn the printer "OFF", press and hold the ON/OFF pushbutton. The Power LED will illuminate Red and change back to Green. When the LED illuminates Green, remove your finger from the pushbutton.

NOTE:
If the printer was powered "ON" during the monitor's power-up sequence, the Midmark logo is printed.

The CMP-10 Mobile Printer contains an Auto Power Off feature. If the monitor and printer become separated and after ten (10) minutes during which no data has been sent to the printer and the Line Feed (LF) pushbutton has not been pressed, the printer will automatically shutoff.

The CARDELL Monitor will periodically send to the printer a "wake-up" message that will disable the Auto Power Off feature.

Sample printouts of both History Modes are shown below.

Figure 12: **Sample Printouts**

```
940V Series Monitor
04-Oct-06 13:56

Patient: _____________________

Notes: _____________________

_____________________________

Events:
Hr:Mn Sys Dia MAP Pls %O2
13:57 135  92 114 156 ***
13:59 140  88 125 125  98
14:01 135  89 102 176 ***
14:01 119  84  96 157 ***
14:03 153  91 123 191  98
14:04 148 102 117 159 ***


940V Series Monitor
04-Oct-06 15:02

Patient: _____________________

Notes: _____________________

_____________________________

Events:
Hr:Mn Sys Dia MAP Pls %O2
15:04 135  72  93  73 ***
15:09 161 103 128 171  98
```

```
940V Series Monitor
04-Oct-06 13:56

Patient: _____________________

Notes: _____________________

_____________________________

Trends:
Hr:Mn Sys Dia MAP Pls %O2
13:57 135  92 114 156 ***
13:58 *** *** *** 155  97
13:59 140  88 125 125  98

14:01 135  89 102 176 ***
14:01 119  84  96 157 ***
14:02 *** *** *** 160  99
14:03 153  91 123 191  98
14:04 148 102 117 159 ***


940V Series Monitor
04-Oct-06 15:02

Patient: _____________________

Notes: _____________________

_____________________________

Trends:
Hr:Mn Sys Dia MAP Pls %O2
15:04 135  72  93  73 ***

15:09 161 103 128 171  98
```

NOTE:
When no patient information is stored in the Trend History, for consecutive minute storage, a break appears in the Trends printout. If the %O2 reading is "***", then the Pulse value (Pls) shown is associated with the NIBP reading.

CHARGING THE PRINTER BATTERY

The printer is equipped with a rechargeable Lithium Ion (LiION) battery pack.

When the printer detects a Low Battery condition within itself, the message “Low Battery” is printed and an audio indicator, located inside the printer sounds three (3) times.

WARNING:
Charge the printer battery using the AC Adapter, Model TRC-09-1100-M from GROUP WEST, or equivalent (supplied with printer).

1) Plug the battery charger’s cord into the printer battery charger jack, located on the rear panel.

2) Plug the charger into an AC wall outlet of the appropriate voltage.

3) Verify the CHARGE LED indicator is lit Red. Battery charge time is approximately three (3) hours. Once the battery is fully charged, the CHARGE LED indicator switches to Green.

CAUTION:
Once the battery has reached a full charge, remove it from the charger. Continued charging of the battery may cause its performance to degrade.

INSTALLING PAPER

NOTE:
A red line appears when the remaining supply of thermal paper becomes low.

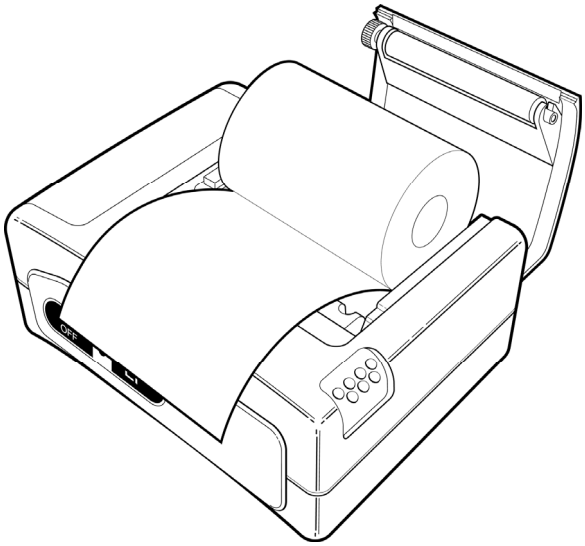
1) Switch the printer “OFF”.

2) Press the Cover Open button to access the paper compartment. Remove any remaining paper before installing the new roll.

3) Place the new paper roll as shown on the illustration and pull out enough paper to reach out over the control panel of the printer.

4) Close the paper door.

Figure 13: **Paper Installation**



NOTE:
Make sure that the paper is correctly placed. If it is tilted in one or another direction and does not come out straight from under the cover, open the door and reposition the roll again.

WARNING:
Do not touch the print head or paper cutter while replacing the printer paper.

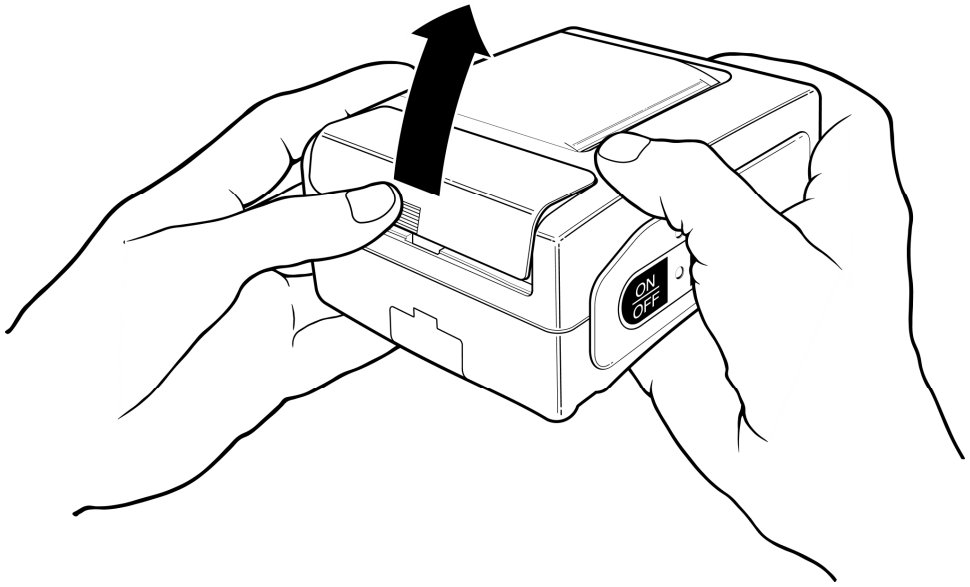
REPLACING THE BATTERY PACK

WARNING:
Do not operate the printer or connect the printer to the CARDELL Monitor with the battery pack removed.

WARNING:
Never change the battery pack while the battery charger is plugged in and/or the CARDELL Monitor is being operated.

1) Switch the printer “OFF”.
2) Disconnect the printer from the CARDELL Monitor and unplug the wall charger cord
3) Open the battery door by pressing in on the battery cover and pushing upward.

Figure 14: **Opening the Battery Door**



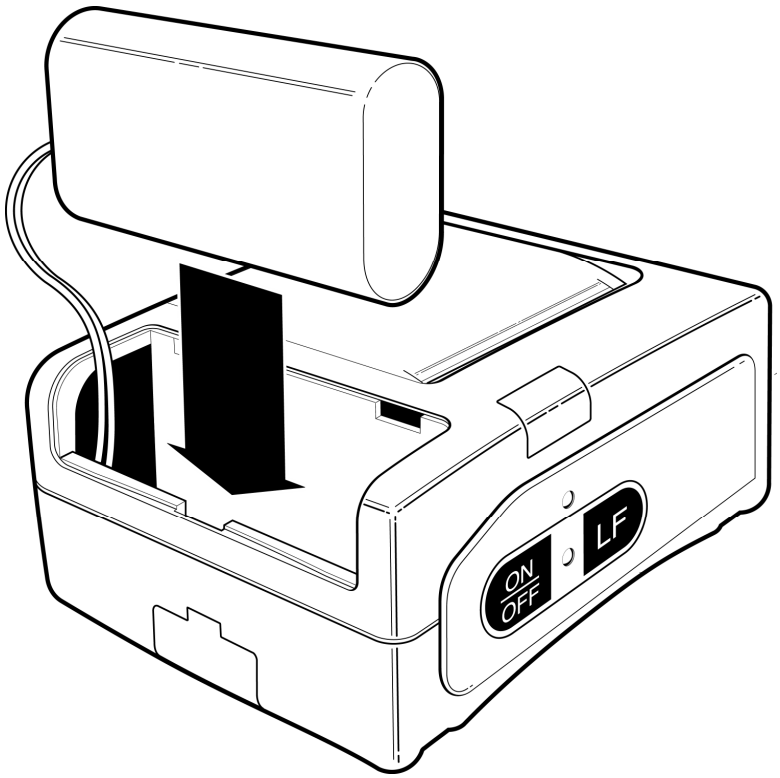
4) Remove the battery cover.
5) Remove the battery pack from the compartment and disconnect its connecting cable.

INSTALLING A NEW BATTERY PACK

1) Connect the battery cable into the battery connector.

2) Insert the battery and its connecting cable into the battery compartment.

Figure 15: **Installing the New Battery**



3) Replace the battery cover by sliding it in from the back of the printer and pushing down to lock it in place.

CAUTION:
Be sure to place the battery cover firmly in its position after installing the new battery pack.

WARNING:
Do not disassemble the battery pack or batteries. The batteries contain electrolytes, which can cause injury to eyes, skin and clothing.

NOTE:
This product contains a rechargeable battery that is recyclable. Under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local authorities for instructions on recycling options in your area.

9. CLEANING

CLEANING OVERVIEW

WARNING:
Do not, under any circumstances, perform any testing or maintenance on the monitor while the monitor is being used to monitor a patient. The monitor must be turned "OFF". Unplug the monitor from the AC power source and remove the internal battery.

CAUTION:
Do not open the monitor to clean or repair it. Contact CAS Medical System for service needs.

CAUTION:
Disconnect all accessories from the monitor before cleaning. Do not immerse any part of the electrical connector of the cable or accessories in the cleaning or disinfection solution at any time. Do not use an abrasive cloth or cleaner on the accessories.

THE MONITOR

On a daily basis, examine the monitor case for any damages and check the AC power cord for bent or broken prongs, cracks or fraying. Neither the monitor nor the power cord should be used if damaged. If any damage is noted, contact the appropriate service personnel.

CAUTION:
Do not spray any water or cleaning solution directly onto the monitor.

As needed, clean the monitor using a soft cloth dampened with a mild dishwashing detergent solution and gently rub the soiled area until clean. Use a clean soft cloth to dry the monitor. Do not use abrasive cleaners on the monitor. Do not use either isopropyl alcohol or solvent to clean the monitor. Use of these cleaners can cause damage to the monitors' surface. Do not immerse the monitor or power cord in the cleaning solution.

When necessary, the monitor surfaces may be disinfected using a soft cloth saturated with a 10% (1:10) solution of chlorine bleach in tap water. When all of the surfaces have been disinfected, wipe the entire surface of the monitor using a soft cloth dampened with fresh water to remove any trace amounts of residue and/or fumes.

NOTE:
Thoroughly wipe off any excess cleaning solutions. Care should be taken to prevent water or cleaning solution to run into connector openings or crevices.

THE DISPLAY

CAUTION:
Use care when cleaning the display. Scratches may occur.

Occasionally, as needed, clean the display window using a soft, lint-free cloth sprayed with an alcohol free glass cleaner. Do not use either isopropyl alcohol or solvent to clean the display. Use of these cleaners can cause damage to the display. The use of paper towels is not recommended as it may scratch the surface.

CUFFS

Prior to each patient use, inspect the blood pressure cuff and its hose for damage.

REUSABLE CUFFS

As necessary, for normal cleaning with mild detergents / dilute bleach solution (1-2%), wipe the cuff with the cleaning solution, rinse with water and dry.

NOTE:
CAS does not recommend submersion of the cuff. Liquid should not be permitted to enter the cuff bladder because instrument damage may occur. The cuff should be allowed to thoroughly dry before use.

DISPOSABLE CUFFS

CAS is aware that, in certain situations, the cuff may become soiled during its use. In these situations a water-based detergent is suitable for wiping the cuff.

As necessary, the preferred method for cleaning the cuff is to wipe it down with a damp, soapy cloth. A damp, detergent-free cloth should then be used to rinse the cuff.

NOTE:
CAS does not recommend submersion of the cuff. Liquid should not be permitted to enter the cuff bladder because instrument damage may occur. The cuff should be allowed to thoroughly dry before use.

PNEUMATIC TUBING

Prior to each patient use, inspect the NIBP Inflation Hose for proper connection, cracks and kinks. As necessary, clean the pneumatic tubing using a soft cloth dampened with a germicidal solution.

PRINTER

When the printer becomes dirty, wipe with a soft dry cloth. For extreme dirt buildup, soak a cloth with mild detergent, wring well and wipe. Dry by wiping with a soft dry cloth.

CAUTION:
Before cleaning the printer, disconnect the AC adapter from the printer.
Do not use volatile chemicals such as thinner, benzine, etc.
Never wet the inside of the printer mechanism.

Refer to the printer User's Manual for more information.

SPO_2 INTERCONNECT CABLE

Prior to each patient use, inspect the SpO_2 Interconnect cable for damage. As necessary clean the cable using a soft cloth dampened with a germicidal solution.

SENSOR AND CLIPS

CAUTION:
To avoid damage to the VetSat sensor, remove it from the clip before cleaning either piece.

CAUTION:
Do not sterilize the sensor or clips by irradiation, steam or ethylene oxide. Do not immerse the sensors in water or cleaning solution.

When necessary, the sensor may be surface-cleaned by wiping it with an agent such as 70% Isopropyl Alcohol.

The clip may be cleaned by either wiping it with, or soaking it for ten (10) minutes in, 70% Isopropyl Alcohol. If the clip is soaked, be sure to rinse it with water and air-dry it prior to use on the next patient.

After each cleaning and prior to each use, inspect the sensor and cable for fraying, cracking, breakage, or other damage. Inspect the clip for cracking or breakage, or loss of spring tension that would allow slippage or movement of the sensor from its proper position.

NOTE:
If defects are noted, do not use the sensor or clip.

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10. MAINTENANCE

MAINTENANCE INTERVALS

Besides the routine cleaning of the monitor and accessories outlined in the previous section, and replacement of accessories due to normal wear and tear, calibration of the monitor should not be necessary during the warranty period.

If the monitor is in need of repair, it must be referred to the appropriate service personnel. Service performed by unauthorized personnel could be detrimental to the monitor and may void the warranty. For service, contact CAS Medical Systems, Inc.

Following the warranty period, preventative maintenance can be an important factor in ensuring the monitor's continuing accurate and reliable performance. The next section of this manual details how the user can perform preventative maintenance and testing. Alternatively, the following program is offered by CAS Medical Systems, and it is recommended that it be performed every two (2) years following the warranty period.

CUSTOMER CARE PLAN - Flat rate list price

Preventative maintenance includes the following:

1. Visual inspection of unit inside and out.
2. Update hardware and software as required through ECN changes.
3. Battery Replacement.
4. Calibration and or adjustments to monitor.
5. All Accessories sent in are evaluated.
6. Pneumatic Check.
7. SpO_2 Functional Check.
8. Pressure Calibration Check.
9. Monitor Safety Leakage Check/ Hi Pot Test.
10. Update labeling where needed.
11. Final Factory Test Procedure using Auto test station.
12. Cleaning
13. QA Inspection
14. One new large adult cuff / Or one VET cuff which ever applies.

Parts replaced if needed at no additional charge. Parts replacements to be determined by repair technician.

1. Front panel key switch
2. Front housing
3. Rear housing

Any circuit boards, which need to be replaced due to malfunction, will have an additional charge on the PM Price. Customers will be provided with an estimate prior to repairs. PM Price also does not apply to units and accessories that have been misused or damaged.

Note: Pricing can change without notice.

TEST MODE

WARNING:
Do not place the monitor in the TEST MODE when a cuff is attached to a patient.

NOTE:
While in the Test Mode if no pushbutton is pressed within 15 minutes, the monitor will automatically terminate the Monitor Configuration menu and return to the “Ready” mode.

The monitor must be in the Configuration Mode in order to perform the following functions:

- All LEDs “ON” Check
- NIBP Calibration Check
  - Manometer Mode
  - Over Pressure
- Pneumatic Pressure Checks

To enter the monitor’s Configuration Menu, press and hold the ALARM LIMITS and VOLUME pushbutton keys while the monitor is being turned “ON” .

Once in the menu, press one of the PREVIOUS (CYCLE TIME / ALARM LIMITS) programmed pushbutton keys until the Message Window briefly displays “TestMode” followed by “0 mmHg”.

EXIT THE TEST MODE

When you have completed with the Test Mode, press the CANCEL pushbutton to exit. The Message Window will briefly display “Saving” and return to the “Ready” state.

LED CHECK

The CARDELL Monitor incorporates an all lights “ON” check to verify the functionality of the front panel LED displays and indicators.

Enter the Test Mode. The Message Window will briefly display “TestMode” followed by "0 mmHg".

Press and hold either the ARROW UP or ARROW DOWN pushbuttons. The monitor will illuminate all appropriate 7-segment displays, bar graph, bell icon and patient mode indicators for as long as the button is pressed.

NIBP CALIBRATION CHECK

Verify the calibration of the monitor once per year.

A Calibration Kit, (product #P9) is included with the monitor. The kit contains a T-connector with a male and a female luer fitting (for a Calibration Check) and a male luer plug (to be used for the Pneumatic Check).

- Manometer Mode
- Overpressure Test
- Pneumatic Test

The following equipment is required to perform the pressure checks:

- Assembled P9 Calibration Kit
- Mercury manometer whose accuracy meets the AAMI/ANSI Standard for Non-Automated Sphygmomanometers, 2002.

MANOMETER MODE

Assemble the Calibration Kit according to the diagram provided in the P9 kit.

1) Assemble the Calibration Kit according to the diagram provided in the P9 kit.
2) Remove the manometer tubing from the inflation bulb. Connect the open ended tubing of the T-connector to the inflation bulb.
3) Connect the female luer fitting to the inflation tube leading to the manometer.
4) Connect the male luer fitting to the manometer tubing.
5) Enter the Test Mode. The Message Window will briefly display “TestMode” followed by "0 mmHg".

6) Use the manometer inflation bulb to slowly inflate the system pausing for 30 seconds at the following points and verify calibration according to the following table:

0 mmHg +/- 1 mmHg
50 mmHg +/- 4 mmHg
100 mmHg +/- 4 mmHg
150 mmHg +/- 4 mmHg
200 mmHg +/- 5 mmHg

NOTE:
If the monitor does not display the test pressure for the 30-second period, deflate to zero and verify the proper assembly of the calibration set-up. Re-inflate the system. If the monitor again fails to hold the pressure, it is recommended the monitor be returned to CAS Medical Systems for service.

OVERPRESSURE

1) While still in the Manometer Mode test, inflate the pressure slowly until 290 mmHg +/- 10 mmHg is reached. The Message Window should stop updating, display the message "OverPres" and provide a NIBP Application Error audible tone.
2) Press the CANCEL pushbutton to exit the Overpressure Test. The monitor returns to the Manometer Mode selection.
3) If the monitor does not meet the above specifications, it is recommended the monitor be returned to CAS Medical Systems for service.

PNEUMATIC PRESSURE CHECKS

Check the monitor's pneumatic system for air leakage every six (6) months.

PLUG TUBE

1) Obtain the male luer plug found in the Calibration Kit (product #P9) supplied with the monitor.
2) Place this plug into the cuff connector at the end of the monitor tubing and twist one-quarter turn. The plug must fit securely into the connector for this test to be performed properly.
3) Enter the Test Mode. The Message Window will briefly display “TestMode” followed by "0 mmHg".
4) Press the START pushbutton to begin the Pressure Check.

5) The Message Window will display “Chk Pres”, will inflate to approximately 180 mmHg and attempt to hold this pressure. The pressure value will be displayed in the SYSTOLIC display window. This test takes about fifteen (15) seconds.

6) At the completion of a successful Pressure Check, the Message Window will display “Passed”, the monitor will beep two (2) times and will return to the Calibration Check function after five (5) seconds.

7) If the monitor fails the Pneumatic Pressure Check, the Message Window will display "Leak", the monitor will beep three (3) times and the return to the Calibration Check function after five (5) seconds.

8) If the monitor fails the Pressure Check, the Message Window will display "Leak", the monitor will beep three (3) times and the return to the Calibration Check function after five (5) seconds.

9) Due to the volume differences of the hoses used with the CARDELL Monitor, the monitor may incorrectly fail the Plug Tube check. Should the monitor fail the Plug Tube Pressure Check, obtain a 500 ml Pressure Cylinder and follow the 500 ml Pressure Check.

500 ml PRESSURE CHECK

1) Obtain a fixed volume 500 ml Pressure Cylinder (CAS p/n 01-02-0248).

2) Place the end of the monitor’s inflation hose securely onto the luer fitting at the top of the pressure cylinder. The hose must fit securely onto the connector for this test to be performed properly.

3) Enter the Test Mode. The Message Window will briefly display “TestMode” followed by "0 mmHg".

4) Press the START pushbutton to begin the Pressure Check.

5) The Message Window will display “Chk Prs”, will inflate to approximately 160 mmHg and attempt to hold this pressure. The pressure value will be displayed in the SYSTOLIC display window. This test takes about fifteen (15) seconds.

6) At the completion of a successful Pressure Check, the Message Window will display “Passed”, the monitor will beep two (2) times and will return to the Calibration Check function after five (5) seconds.

7) If the monitor fails the Pressure Check, the Message Window will display "Leak", the monitor will beep three (3) times and the return to the Calibration Check function after five (5) seconds.

8) Should the monitor fail the 500 ml Pressure Check, it is recommended the monitor be returned to CAS Medical Systems for service.

OXIMETRY CALIBRATION CHECK

The oximeter is factory calibrated to determine the percentage of arterial oxygen saturation of functional hemoglobin. No user calibration is required.

REPLACING THE MONITOR BATTERY

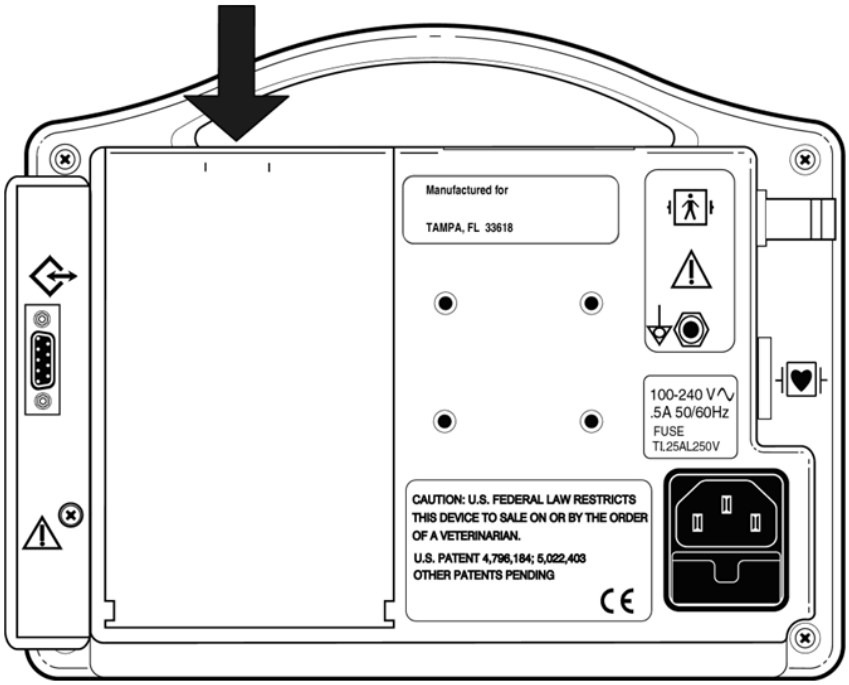
A part number for the battery can be found in the ACCESSORIES section of this manual or on the label located on the inside panel of the battery pack. When the battery fails to hold a charge it will need to be replaced.

CAS Medical Systems recommends the battery be changed every two (2) years.

REMOVING THE BATTERY

1) Turn the monitor “OFF” and disconnect the power cord.
2) Push down on the battery latch to unlock the battery door from the rear panel of the monitor.
3) Carefully remove the battery pack from the rear panel of the monitor. Refer to Figure 16.

Figure 16: **Removing the Battery Pack**



INSTALLING THE BATTERY

1) Align the Battery Pack guides with the bottom of the monitor.
2) Slowly close the battery door to ensure the connector in the monitor and the connector on the battery pack mate together.
3) Lock the battery door closed.

Refer to Page 72, BATTERY POWER for additional battery information.

NOTE:
When the battery pack is re-installed, the monitor will automatically turn “ON”.

WARNING:
Do not disassemble the battery pack or batteries. The batteries contain electrolytes, which can cause injury to eyes, skin and clothing.

NOTE:
This product contains a rechargeable battery that is recyclable. Under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local authorities for instructions on recycling options in your area.

CHANGING THE FUSES

The CARDELL Monitor uses a dual fuse power input receptacle. The receptacle incorporates fuses in the hot and neutral AC input lines that are user serviceable.

Refer to Section 11, ACCESSORIES for part number information.

NOTE:
Refer to the monitor’s rear panel label for the proper fuse rating.

CAUTION:
For continued protection against fire hazard, replace only with identically rated fuses.

A fuse may need to be replaced if the monitor is plugged into an electrical outlet but the Battery Power Visual Indicator is not illuminated the color Green.

WARNING:
Before changing the fuse, unplug the power cord.

The fuse holder is incorporated into the power input receptacle and located under the power cord input connector.

To replace the fuses:

1) Turn the monitor “OFF” and disconnect the power cord from the back of the monitor.
2) Press down on the locking tab, which holds the fuse holder in the power input receptacle.
3) While holding down on the tab, pull the fuse holder out.
4) Remove the fuses.
5) Place new fuses directly into the fuse holder.
6) Insert the fuse holder into the power input receptacle. There should be an audible “click” when it is secure.

STORAGE

WARNING:
If it becomes necessary to store the monitor for longer than six (6) months, remove the monitor’s battery pack and place the monitor in its original packing container if available.

WARNING:
Use of unapproved batteries will invalidate the product’s warranty and may result in serious safety consequences for the patient and user.

NOTE:
Batteries not charged and left in storage for more than six months could degrade and not recharge to full capacity.

See Section 13, SPECIFICATIONS, for storage temperature information.

11. ACCESSORIES

BLOOD PRESSURE CUFFS

Reusable Blood Pressure Cuffs (single tube)

Catalog Number	Width	Range
SV8	8.0 cm	13 – 20 cm
SV10	10.2 cm	18 – 26 cm

Disposable Blood Pressure Cuffs (single tube)

Catalog Number	Width	Range
SV1	2.0 cm	3 – 6 cm
SV2	2.5 cm	4 – 8 cm
SV3	3.5 cm	6 – 11 cm
SV4	4.0 cm	7 – 13 cm
SV5	5.0 cm	8 – 15 cm
SV600	Box of 5 (one each SV1-SV5)	

OXIMETRY

Note: Use only with Nellcor® Pulse Oximeter Accessories

Catalog No.	Description
01-02-0183	Patient Interface Cable, DOC-10, 10 Feet
01-02-0299	VetSat® SpO_2 Sensor and Clips
MaxFast-1	Reflectance Sensor & Posey wrap

OTHER ACCESSORIES:

Catalog No.	Description
01-02-0395	Replacement Power Cord, U.S.A.
01-02-0386	Replacement Power Cord, European
01-02-0385	Replacement Power Cord, Australian
01-02-0384	Replacement Power Cord, U. K.
03-08-0450	Monitor Battery Pack (7.2 VDC, 3700 mAhr)
01-01-0047	P9 Calibration Kit (includes T - connector with tubing and male luer plug)
01-02-0248	500 ml Fixed Volume Cylinder
01-02-0172G	Roll Stand with Basket
01-02-0174	Carry Bag
01-02-0189	Printer, includes Battery, RS232 Cable, Power Supply, One (1) Roll of Paper and Manual
01-02-0181	Printer Bracket Attachment for Roll Stand
01-02-0300	Printer Mount Attachment for Monitor
28-02-0077	Printer Paper, One (1) Roll
01-02-0266	Printer Power Supply Adapter Plug, European
01-02-0267	Printer Power Supply Adapter Plug, UK
01-02-0268	Printer Power Supply Adapter Plug, Australian
01-03-0162	Cardell NIBP Inflation Hose, Six (6) Feet
01-03-0239	Equine NIBP Inflation Hose, Ten (10) Feet
09-01-0002	Fuse (250V, 500mA, 5x20 mm, Slow Blow), 2 per monitor – per labeling on monitor's rear panel
09-01-0034	Fuse (250V, 1.25A, 5x20 mm, Slow Blow), 2 per monitor – per labeling on monitor's rear panel
01-02-0176	RS232 Communication Module
21-02-0285	Cardell Monitors Model 9401 and 9402 User's Manual

MONITOR CONFIGURATIONS

Table 8: **Monitor Configurations**

Model	Description
9401	MAXNIBP® Non-invasive Blood Pressure and Pulse Rate, 100-240V, 50/60HZ, AC Power Supply and Battery
9402	MAXNIBP® Non-invasive Blood Pressure, Pulse Rate and Nellcor Veterinary SpO_2, 100-240V, 50/60HZ, AC Power Supply and Battery

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12. GLOSSARY

Diastolic
The Diastolic pressure is the bottom (lower) number given in a reading. This number represents the amount of pressure present in the system between heartbeats.

NIBP
Non-Invasive Blood Pressure. Abbreviation used when a blood pressure reading is taken externally using a non-invasive procedure.

SpO_2 (%SpO_2)
Abbreviation used when oxygen saturation level of the blood is measured with a pulse oximeter.

Systolic
The Systolic pressure is the upper (top) number given in a reading. This number represents the maximum pressure present in the artery.

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13. SPECIFICATIONS

NIBP MEASUREMENT

Characteristic	Specification
Technique:	Oscillometric (MAXNIBP® Technology) Microprocessor software eliminates most ambient noise and motion artifact.
Blood Pressure Range	
Systolic:	25 – 265 mmHg
Diastolic:	15 – 220 mmHg
MAP:	20 – 235 mmHg
Pulse Rate Range:	30 – 300 BPM
Accuracy	
Blood Pressure:	+/-5 mmHg with a standard deviation no greater than 8 mmHg (See Standards)
Pulse Rate:	+/-2% or +/-2 BPM, whichever is greater

%SpO_2 MEASUREMENT

Characteristic	Specification
Nellcor®	
Type:	Functional Oxygen Saturation
SpO_2 % Range:	1 - 100%
SpO_2 Accuracy:	70 - 100%, +/-2 digits (1 S.D.) Adult
	70 - 100%, +/-3 digits (1 S.D.) Neonate
Measurement Wavelengths:	Red 660 Nanometers
	Infrared 890 Nanometers
Power:	Not exceeding 15 mW
Pulse Rate Range:	20 - 300 BPM
Pulse Rate Accuracy:	+/-3 digits
Numerics:	Updated every one (1) second.

NOTE:
Accuracy is specified for adult human hemoglobin measured at the fingertip. Although animal hemoglobin has similar optical characteristics, other types of hemoglobin may affect the accuracy.

PATIENT ALARMS

	9401		9402	
Patient Parameters				
	Low Limit	High Limit	Low Limit	High Limit
SYS:	30 – 260	30 – 260	30 – 260	30 – 260
DIA:	20 – 215	20 – 215	20 – 215	20 – 215
MAP:	25 – 230	25 – 230	25 – 230	25 – 230
Pulse:	35 – 295	35 – 295	35 – 295	35 – 295
% SpO_2:			70 – 95	80 – 99
SpO_2 Pulse:			25 – 295	25 – 295

NOTE:
Each alarm limit may also be selected “OFF” individually or as a whole.
Low Limits cannot be set above the associated High Limit.
High Limits cannot be set lower than the associated Low Limit.

CONTROL PANEL

Characteristic	Specification
Display:	LED display of measurement results, instructions, troubleshooting messages and signal strength bar.
Parameters Displayed:	Systolic Pressure, Diastolic Pressure and Mean Arterial Pressure (MAP)
	Pulse Rate
	%SpO_2

OPERATING MODES

Characteristic	Specification
Patient:	Veterinary
NIBP:	Manual, STAT or Automatic (at preset intervals)
History:	Reviews previous measurements
%SpO_2:	Continuous Monitoring

POWER

Characteristic	Specification
Source:	External line or internal battery
AC Power Option:	100 - 240 VAC, 50/60 Hz, 0.5A; Fuse Rating – T500mAL250V or T1.25AL250V (two provided) Refer to monitor rear panel labeling for actual fuse rating.
Battery:	Nickel Metal Hydride (NiMH) battery pack (user removable)
	Charge Time: 4 hours
	Operation on battery: 100 NIBP readings when set in the 5-minute Automatic Mode.
Leakage Current:	100 microamp (maximum)

FEATURES

Characteristic	Specification
Self Test:	System self test is performed each time power is turned on.
Auto Zero:	Zero pressure reference is automatically established after every reading.
Inflation:	Initial inflation to 150 mmHg or user selectable (100, 120, 140, 150, 160, 180, 200). Subsequent inflation to approximately 30 mmHg greater than previous Systolic pressure.
Deflation:	Automatic
Max Measurement Time:	Limited to 150 seconds

SAFETY LIMITS

Characteristic	Specification
Automatic Cuff Deflation:	If cuff pressure exceeds 290 mmHg
	If measurement time exceeds 150 seconds
	If safety timer detects microprocessor failure

OPERATING ENVIRONMENT

Characteristic	Specification
Operating Temperature:	0°C to 50°C (32°F to 122°F) – for NIBP & SpO_2
Humidity:	15 - 95%, non-condensing
Altitude:	10,000 to -1,250 ft. (700 – 1050 hPa)

Monitors may not meet performance specifications if stored or used outside temperature and humidity ranges. When moving the monitor from a storage location, wait at least one-hour prior to use to allow the monitor to adjust to room temperature.

STORAGE/TRANSPORT ENVIRONMENT

Characteristic	Specification
Storage / Transport Temperature:	-20°C to 65°C (-4°F to 149°F)
Humidity:	15 - 95%, non-condensing
Altitude:	10,000 to -1,250 ft. (700 – 1050 hPa)

PHYSICAL DIMENSIONS & WEIGHT

Characteristic	Specification
Base Unit	
H x W x D:	6.75 in x 8.5 in x 3.0 in
	(17 cm x 21.5 cm x 7.5 cm)
Weight:	3 lbs approx. (1.4 kg)

SERIAL INTERFACE

Characteristic	Specification
Interface:	Bidirectional serial communication
Speed:	9600 for Printer 115200 for CAS Serial Protocol
Signal Level:	RS232C
Data Length:	8 bits
Start Bit:	1 bit
Stop Bit:	1 bit
Parity:	None
Flow Control:	None

STANDARDS

Units comply with the following requirements:

IEC 60601-1
EN 60601-1-2
EN 60601-2-49
EN 865
ETL Listed - UL 2601, CAN/CSA C22.2 No. 601.1

CARDELL® is a registered trademark of Midmark.

CASMED®, MAXNIBP®, Tuff-Cuff®, Safe-Cuff®, SoftCheck®, UltraCheck® and "*FOR WHAT'S VITAL*" are registered trademarks of CAS Medical Systems, Inc.

Nellcor®, VetSat® and OxiMax® are registered trademarks of Mallinckrodt Inc. SatSeconds™ is a trademark of Mallinckrodt, Inc.

Velcro® is a registered trademark of Velcro USA, Inc.

All units covered by U.S. patent 4,796,184 and 5,022,403. Other patents pending.

Monitors are CE marked.

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14. PURCHASING RECORD

CARDELL VETERINARY MONITOR

Model Purchased
(select one): 9401 ( ) 9402 ( )

Serial Number: _____

Date of Purchase: _____

Distributor Name: _____

Representative: _____

Phone Number: _____

Fax Number: _____

Email: _____

Midmark Corporation
60 Vista Drive
Versailles, OH 45380-0286
Phone: 937-526-3662
Fax: 937-526-5542
midmark.com

MIDMARK®

Because we care.

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